SCIENTIFIC AMERICAN

AUTOMOBILE NUMBER

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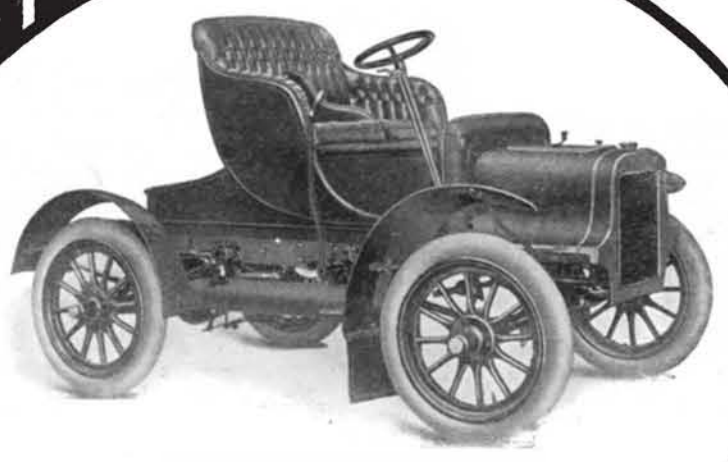
The Car that Achieves

The Cadillac has always been the car that *does* things. Whether the test be that of endurance or power, or one of severity of road service, this wonderful machine has never been found wanting. It knows no balk, no hesitancy, no delay—always ready, with energy to spare.

By this dependability of service, coupled with unusual economy of maintenance, the Cadillac has made such phenomenal advancement that its factory is now the largest of its kind in the world.

The qualities upon which this unparalleled growth is based are more pronounced than ever in the magnificent new cars for 1906. Embodied in these are many unique and important improvements — improvements which make the

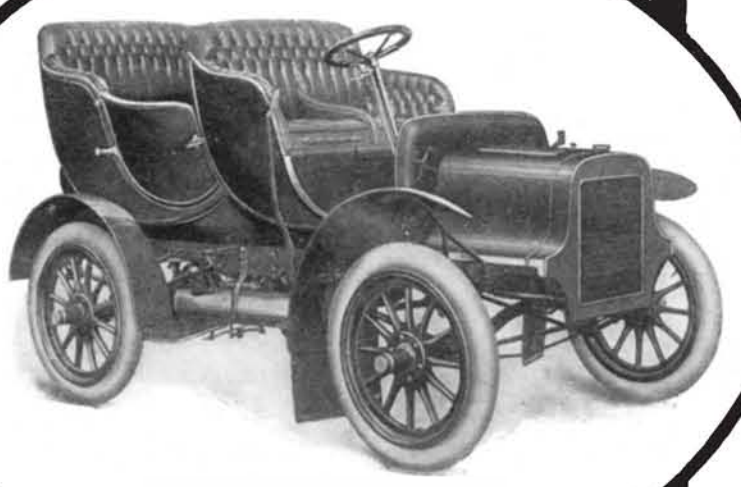


Model K, 10 h. p. Runabout, $750, f. o. b. Detroit.

CADILLAC

conspicuous for its *individual* merit.

Among them is a wonderful mechanical feed lubricator which supplies oil to the motor in quantities which vary according to the speed of the engine, when properly adjusted, always feeding enough, never too much or too little. The new rocker joint on the front spring allows the car to pass over obstacles several inches in height without transmitting any material jar to the car, insuring a maximum of riding comfort and a minimum liability to breakage.



Model M, Light Touring Car, $950, f. o. b. Detroit.

In outline and finish these new Cadillacs are truly art creations. Of the Victoria type, their grace and exquisite beauty, their tone of quiet richness, appeal at once to fastidious motorists.

We want to tell you more about the Cadillac by sending you a free copy of our interesting Booklet N. A postal request brings it, together with address of nearest dealer. The 1906 models include:

Model K, 10 h. p. Runabout, $750.
Model M, Light Touring Car, $950.
Model H, 30 h. p. Touring Car, $2,500.
Model L, 40 h. p. Touring Car, $3,750.

All prices f. o. b. Detroit.

CADILLAC MOTOR CAR COMPANY, Detroit, Mich.

Member Asso. Licensed Auto. Mfrs.

SCIENTIFIC AMERICAN

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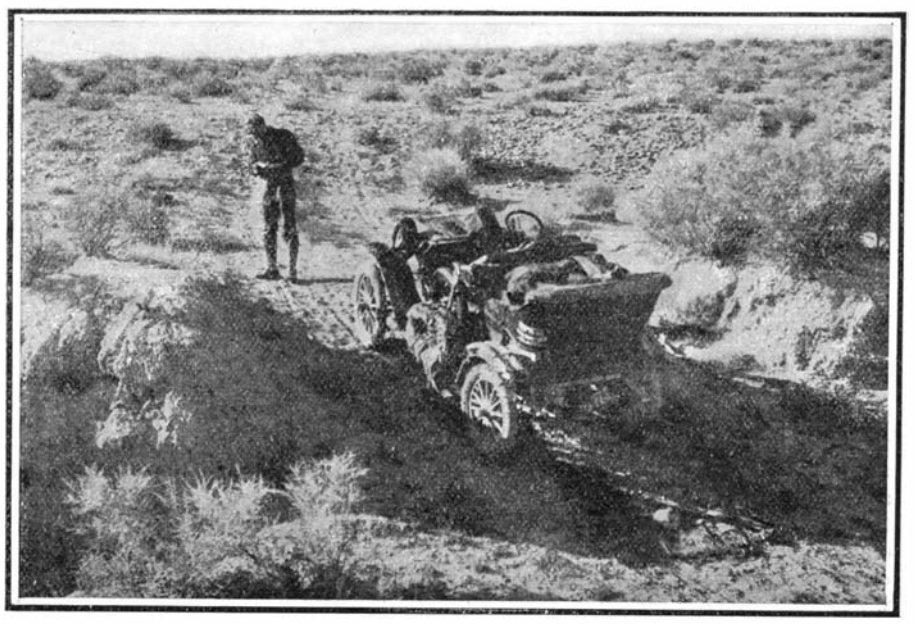
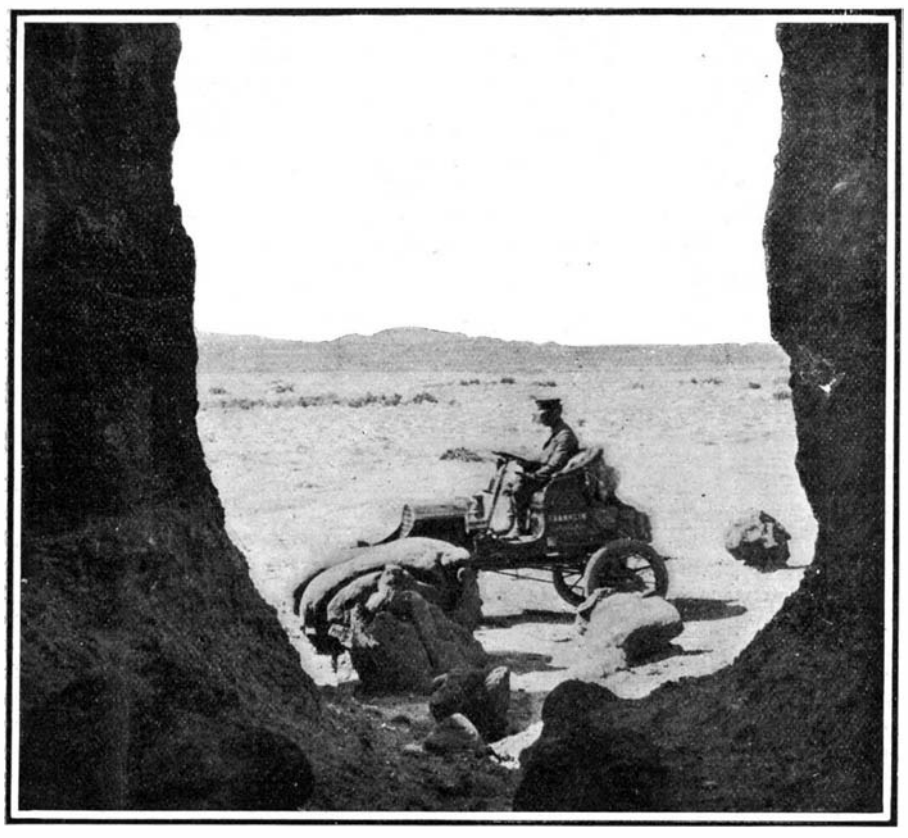
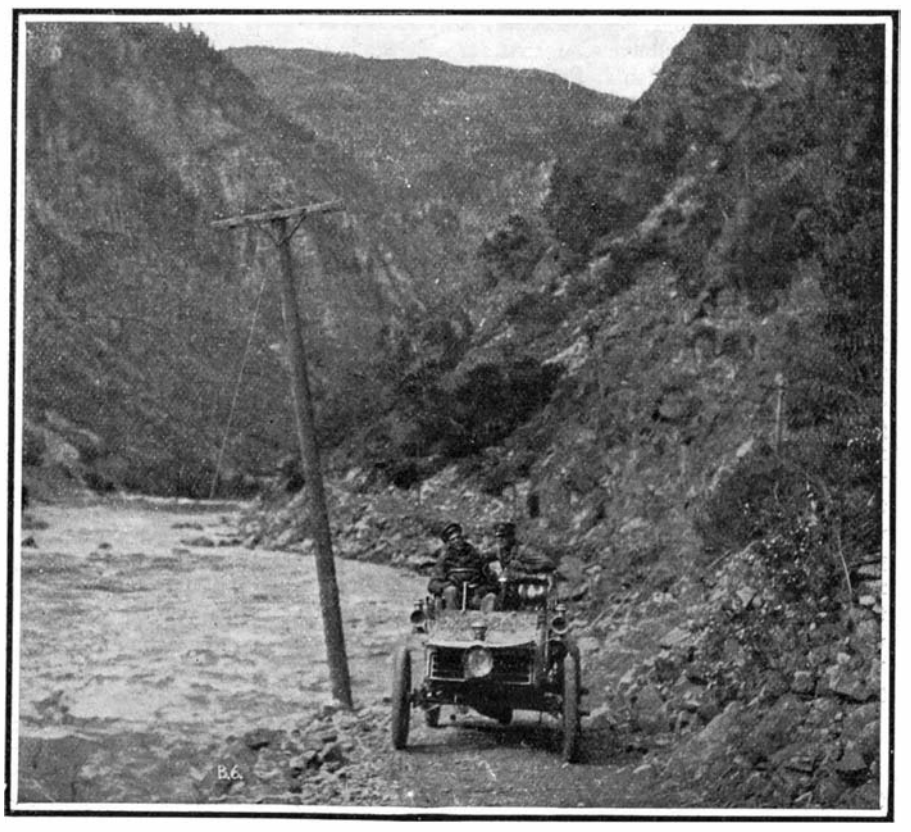
Water Toboganning in the West.



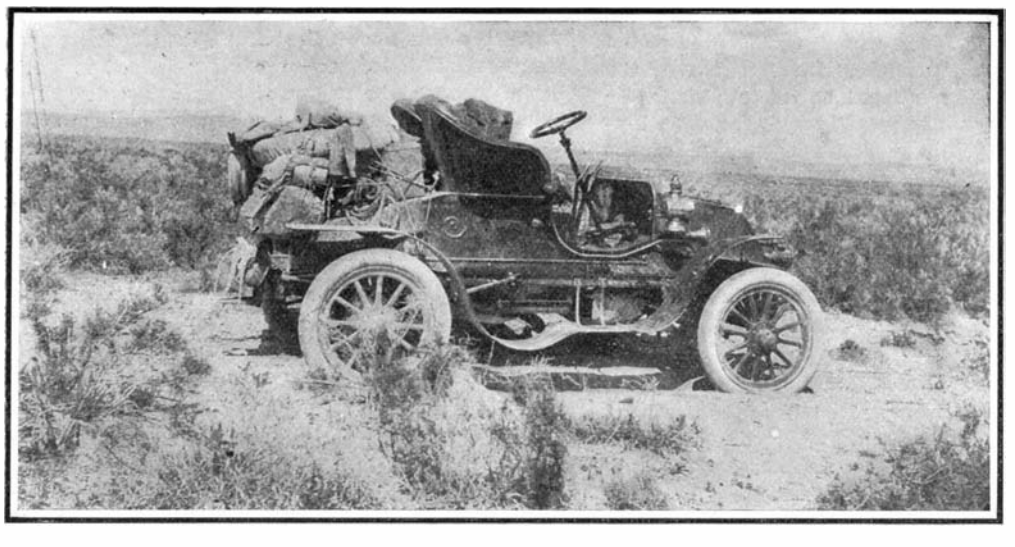
Reo "Mountaineer" Among the Hills and Sage Brush of Central Oregon.



The Air-Cooled Franklin Framed in the Walls of a Wyoming Canyon.



The Packard Proceeding Cautiously Through a Grand Western Gorge.



The First Car to Cross the Continent Resting in the Desert Sands.

The Winton Undergoing a Severe Tire Test.

TRYING EXPERIENCES DURING THE TRIPS OF CARS THAT HAVE CROSSED THE CONTINENT.—[See page 24.]

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NEW YORK, SATURDAY, JANUARY 13, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

FUTURE OF DIRECT-CURRENT TRACTION.

The controversy as to the relative merits of direct and alternating current traction, particularly with reference to steam railroads, shows no signs of abating. It was aroused by the fact that two great railroad systems which enter the same New York terminus, and use the same suburban and terminal tracks for a distance of several miles, are employing two different types of motor, one direct-current and the other single-phase alternating current. The controversy is wider than that of merely the two railroads concerned, for it includes the two largest electrical manufacturing concerns in the world; one the General Electric Company, which is furnishing the direct-current equipment, both for power stations, lines, and rolling stock; and the other the Westinghouse Company, which is furnishing the single-phase alternating equipment for the New Haven lines from Stamford to their junction with the New York Central system at Woodlawn. The alternating-current advocates have expressed surprise that such an important installation as that of the New York Central terminal lines should have been equipped with the direct current, arguing that it is approaching the stage at which it will not compare in economy, particularly for long-distance work, with the more convenient and flexible alternating current.

It is stoutly maintained by the direct-current advocates, that it has by no means reached its final stage of development, as proved by the fact that recently tests and results of 1,500-volt direct-current railway motors have become available, and that there are rumors of a 700-mile direct-current transmission. It is urged that 500 to 600 volts is merely a stepping stone to more efficient pressures, which are sure to be used. A correspondent of one of the contemporary journals devoted to street railways, claims that it is now practically possible to furnish reliable direct-current railway apparatus for a voltage of from 1,000 to 1,200 pressure; and that with proper designing of the magnetic circuit in the motors, and the placing and insulation of the controlling apparatus, there is no reason why the advantages of high voltage should not be realized under the direct-current system, as they now are in the alternating system.

DESIGNING THE STEAM TURBINE.

It is seldom that, in the development of a new art, the public is taken into the confidence of the designer, and treated to such a luminous exposition of the principles that govern both design and construction, as is given in a paper recently read by Mr. E. M. Speakman before the Institution of Engineers and Shipbuilders in Scotland, on the Dimensions of the Marine Steam Turbine. Although there have been many papers read on the general subject of the steam turbine, we doubt if there is any approaching this paper in the completeness of the ascertained data that it contains. In the nature of things, turbine design was, in the earlier stages, and in some respect is yet, largely empirical; and hence, results that have been established in the day-by-day working of the marine steam turbine are, just now, of extreme value. Limitations of space prevent us from giving this paper, which is published in full in the current issue of the SUPPLEMENT, more than a brief review in these columns.

Turbine efficiency and propeller efficiency must be considered separately, and also together, because it may be found that the use of revolutions somewhat below the maximum obtainable will increase the combined efficiency; while on the other hand to obtain certain advantages in weight and space, this efficiency may be slightly sacrificed at the highest speed. Roughly speaking, the weight of the turbines will vary inversely as the square of the revolutions. The minimum size of propeller required to avoid cavitation must be calculated at the beginning of any design, as it is almost impossible to assume certain revolutions, and later on to design a propeller to suit. Cavitation is partly the result of attempting to obtain too much work per square foot of blade area, and partly of excessive peripheral speed. It has been found by bitter experience that there is a narrow limit to the tensional pressure possible on the water, beyond which propeller efficiency drops very rapidly. This pressure is approximately from 10 pounds to 12 pounds per square inch at the depth of 12 inches below the surface. The speed of the tips of the blades of turbine-driven propeliers varies from the enormous velocity of 12,400 feet per minute in the British torpedo-boat destroyer "Viper" of 36 knots speed, whose screws were 3 feet 4 inches in diameter, down to 8,125 feet per minute on the "Carmania," whose screws are 14 feet in diameter. The percentage of slip has varied from 28 per cent in the "Viper" down to 14 per cent in the Channel steamship "Viking." In the large ocean-going vessels, the slip is from 16 to 20 per cent.

Although the laws governing the best velocity of steam and blades are similar to those for water turbines, some modification is necessary in practice, and the best ratio of blade speed to steam speed is still a matter of opinion. This ratio has varied in Parsons turbines from 0.25 to 0.85 of *Vs* where *Vt* represents blade velocity of mean diameter, and *Vs* steam speed due to expansion across the row in question. The steam consumption must be accurately known in order to proportion these ratios correctly. With these results before us, we are not surprised to hear Mr. Speakman say that the best blading arrangement, scientifically and commercially, is the result of much theory and practice, and that this data being based on long and costly experiments is naturally withheld from publication. With regard to speed of turbine blades, we are told that blade speed is governed to some extent by blade height; and that the speed should be so modified that this may be at least three per cent of the mean diameter to reduce the proportion of clearance losses.

Leakage over the tips of the blades is, perhaps, not so detrimental on account of actual leakage loss as in its superheating effect on the steam between the row past which it leaks and the last row, which seriously affects the fluid efficiency. That the turbine is not suited to slow vessels is due to the fact that the propeller controls the speed of revolution, and to the fact that there is a necessary proportion between the blade height and the diameter. In slow cargo steamers, though the revolutions may be high enough, the power required is not sufficient to enable a sufficient blade height to be adopted for the prevention of undue leakage. The ratio of blade height to mean diameter should not be less than 3 per cent or more than 15 per cent, because in the first case leakage will be excessive, and in the latter the bending moment on the blades becomes too great. The trouble with the stripping of the blades may be set down to bad workmanship, defective blade material, whipping of turbine spindles (due to bad design or bad balancing), and to excessive cylinder distortion due to temperature. This last is the most fruitful cause, and is a serious one, being due entirely to poor design. Great care must be taken in proportioning the cylinders; for under wide ranges of temperature, when the turbine is working there may be a fall from 400 deg. to 100 deg. F. in a distance of 6 or 8 feet. The radial expansion, therefore, is greater at one end than the other. Hence, ample clearance must be allowed. This clearance will vary from 3/16 of an inch for a 1-inch blade to ½ an inch for a 10-inch blade, and ¾ of an inch for a 30-inch blade.

Finally, on the question of the performance of turbines as compared with reciprocating engines for marine work, both the Admiralty and the British railroad companies that employ Channel steamers have been able to test similar ships under the same conditions and secure most reliable data. In the earlier trials of the cruiser "Amethyst," it was shown that only below 55 to 60 per cent of its full speed does the consumption of the turbine exceed that of the piston engines. In later trials of the "Amethyst," after the steam piping had been altered so as to permit the auxiliary exhaust steam to pass through the main low-pressure turbines, the low-speed consumption of the "Amethyst" was brought down below that of her sister ships for all speeds to 10 knots an hour, which is about 45 per cent of her full speed.

THE AUTOMOBILE IN 1906.

The annual automobile exhibition in New York city, for the year 1906, marks a distinct advance on its predecessors on every point of comparison. In respect of magnitude, it is sufficient to say that two of the largest buildings in this city are required to afford sufficient space for the exhibition of the automobiles and their accessories. In order to separate the exhibits into two distinct groups, the Licensed Association of Automobile Manufacturers confined their display to Madison Square Garden, showing only cars which are licensed under the Selden patent, while the Automobile Club of America houses its display in the handsome new armory of the Sixty-ninth Regiment, the entries in this show being confined strictly to cars that are unlicensed. Not only is the display far larger than any that has preceded it, but the buildings themselves have been decorated and arranged on a plan which renders the effect extremely handsome. Elsewhere in the present issue we have illustrated and described individual cars, that represent the present progress in the art of automobile manufacture; and it is, therefore, our purpose in the present article merely to outline what might be called the type touring car, as evolved during the past ten years of the development of the industry in the United States.

The standard car, then, at the opening of the year 1906, is a four-cylinder touring car of 24 to 28 horsepower, weighing from 2,000 to 2,200 pounds, or a 30 to 35 horse-power machine, weighing from 2,200 to 2,400 pounds. The four-cylinder motor is housed in a bonnet at the front, and the power is transmitted through a three-speed, sliding-gear transmission by shaft-drive and bevel gears to a live rear axle. The wheels are distinctly larger, being 32 to 34 inches in diameter, with large tires 4 or 4½ inches in diameter. Our standard car shows marked improvement in the arrangements for lubrication of the engines, a continuous circulation being secured by some form of mechanical forced-feed oiler, the oil passing through sight-feed glasses carried at the front of the machine on the dashboard. The familiar leather-lined cone-clutch has given place to a multiple-disk clutch, and as the disks run continually in oil, there is a certain amount of slip when the disks are first compressed, so that the clutch takes hold without jar or jerk. This renders it possible to start a car on the high speed from a standstill.

Although the majority of the cars still make use of cooling water and a centrifugal circulating pump, there is evidence that the air-cooled motor may ultimately become the prevailing type, even for the high-powered car. Two makers exhibit this year six-cylinder, air-cooled motors. They were encouraged to take this step by the good results that have been obtained by air-cooled motors in the various reliability and economy runs that have been held during the past year. Another make secures its cooling effects by permitting the cylinders themselves to revolve; but practically all of the others make use of fans, one of the few exceptions being that of a light four-cylinder runabout, one of which performed the feat of crossing the continent. There is no question that the air-cooled car has falsified the predictions of failure which have been made freely in the past; and the good results secured are to be attributed to a careful study of conditions and well-thought-out design. The powerful air-cooled car is distinctly an American production, and the fact that it has won its way to successful recognition among the higher-powered machines is a subject of congratulation to those who would like to see the United States contribute more fully than it yet has done to the development of the perfect automobile.

Although the four-cylinder, four-cycle motor is the standard type to-day, the two-cycle motor is making distinct progress. One of the oldest manufacturers in the United States has worked on the problem with such success that he has brought out a two-cylinder, 25-horse-power touring car which weighs only 1,700 pounds. If certain inherent disadvantages of the two-cycle motor, such as the small range of speed, and the difficulty of keeping the crankcase tight, can be overcome, there are certain manifest advantages, in the way of lighter weight and greater simplicity, that will tend to make this type a favorite. It is quite possible that the future motor will be of the two-cycle, four-cylinder, mechanically air-cooled type; such a motor, except for the air-cooling feature, is shown in the exhibition. That this type can work successfully in the larger sizes would seem to be proved by the fact that a western railroad, which has been very active in the introduction of gasoline motor cars on its system, has recently received a four-cylinder, air-cooled, two-cycle motor of 200 horse-power for one of its new cars. The abolition of the valves, the circulating water pump and radiator, and the reduction of weight per horse-power in the motor, would mark a decided step in advance in respect of the weight, cost, simplicity, and convenience of operation of the automobile.

But to return to our typical car; we note that it is fitted with spring-separated ball bearings in the transmission and the wheels, with the choice of roller bearings for the rear axle, wheels, and countershaft. Ball bearings have been in use now for two seasons, and may be considered as standard practice. We note that one car shows roller bearings on the ends of the engine crankshaft. The greater ease and smoothness of running are attributed to shock-absorbers, rebound-checking devices, and pneumatic tires of large diameter. Although our type car does not carry them, we observed that inventors have been busy endeavoring to find some device which will permit of the use of solid tires on the road wheels, without losing the shock-absorbing and high tractive efficiency of the pneumatic tire.

The standard car depends for ignition upon the jump spark, with high-tension magneto or storage battery; although we noted in the exhibit several

cases of low-tension magneto ignition. The valves are mechanically operated and are interchangeable, two sets being used, one on each side of the motor. The type car may carry either cellular radiators or those of the finned tube pattern, while some of the cars use flattened tubes provided with radiating fins. The type car carries two separate brakes, one of the expanding ring type, the other a band brake, acting within and on the outside of a drum on the rear wheel. The band brake, worked by a pedal, is for ordinary use, and the expanding ring brake, which is applied by the hand, is used for emergency. Finally, we note that the engine is controlled by separate spark and throttle levers, mounted on stationary sectors in the steering wheel.

It is a matter of congratulation that the industry has now grown to such proportions that the manufacturers are enabled to turn out a standard car which is at once superior in construction and lower in price.

PROGRESS WITH THE ELECTRIC AUTOMOBILE.

Although King Gasoline has gone on rapidly conquering the world, the beggar maid, Electricity, is soon coming to her own. She has been hard at work for the past several years doing more and more of the world's drudgery, and, according to present indications, she will yet have the honor of moving a considerable percentage of its pleasure vehicles as well.

The improvements that have been made in electric automobiles are of two kinds, namely, those in the vehicle and motor, and those in the battery. One class is quite as important as the other and the changes made during the last few years have been almost as great in the one as in the other. The result is that the modern electric vehicle for pleasure purposes can now be constructed to consume only about 50 watt-hours per ton mile at a speed of 15 miles an hour, where some years ago it used nearly three times as much; and reliable batteries delivering 15 to 18 watt-hours per pound can be had, as against the 8 or 9 watt-hours of usual practice. Thus it will be seen that vehicle and batteries have improved 100 per cent. That this is not merely theoretical improvement is seen from the fact that an electric stanhope having a guaranteed mileage of 85 on a charge, is now on the market, and larger, long-distance pleasure vehicles are being rapidly perfected. In France last fall several "raides electriques" were made to show what can now be done with ordinary stock vehicles. The most notable of these was the run from Paris to Trouville (about 130 miles) on one charge. Even more worthy of notice was a trip in this country from Cleveland to Erie (100 miles) over ordinary country roads some of which were sandy and which included several steep hills. A trip such as this on one charge makes the possibility of the practical electric touring car seem within grasp. With the high-capacity batteries and the improved motors and methods of power-transmission, the discharge rate of the battery is lowered with respect to the capacity, which results in lengthened life, so that a year of service can be assured before the replacement of the positive plates becomes necessary. A set of negative plates will usually outlast two sets of positives, and the upkeep of the battery can usually be placed at a fixed sum per annum.

Regarding types of storage battery other than the lead-lead type, there has been no great advancement of late. The lead-zinc battery, if ever perfected, will doubtless be the ideal battery, as the light weight of such a battery (25 watt hours per pound) coupled with its high voltage (2.5 volts) and heavy rate of discharge possible make it just what is needed for automobile work. The Edison battery is practically perfect in the last-named respect, as a heavy discharge does not affect the capacity. Bulk-for-bulk, too, the Edison battery is lighter than those of the lead type. Its low voltage (1.25 volts), however, makes more cells necessary, and it suffers such a serious loss of capacity under the effect of cold as to make it impractical. The results of an interesting series of tests of this battery by a well-known foreign electrochemist were published recently in the SUPPLEMENT. Despite the defect mentioned, this expert believes that batteries of the Edison, or nickel-iron, type will in a few years drive the lead battery from the field.

The method of power transmission found to be the most efficient is a single motor with individual chain drive from a countershaft to the rear wheels. On heavy vehicles two motors are generally used, but the chain drive replaces the old-time spur gear. With two motors the battery cells can always be connected in series, and none can be discharged more than others. But if a connection breaks the vehicle is stalled until a repair is effected. The low-voltage battery (12 to 24 cells) is largely used for light vehicles and even some of the largest machines are now so equipped. Its advantage is a smaller number of cells; its disadvantage, inefficiency in charging from 110-volt circuits, as energy is lost through a rheostat.

In the business and commercial vehicle line, for city work, the electric still reigns supreme. Hansom cabs, coupés, delivery wagons, and trucks are daily increasing in numbers. Besides their readiness in all weathers they do not emit smoke or the odor of half-burned gasoline—a nuisance that has become so great as to be the subject of legislation and police interference in London. The speed of the passenger-carrying electrics is as great as that of the corresponding gasoline car for city work, and they have all the advantages, without the liability to breakdown of the latter.

Among novelties in the electric vehicle line may be mentioned an electric tractor, or fore-carriage, which can be used with various bodies, and a trolley arrangement by which an electric automobile can be run by current from the street railway trolley wire, and at the same time recharge the batteries, when following the track.

INCREASING DEMAND FOR THE MISSISSIPPI PEARL.

BY K. L. SMITH.

If the truth were known about many of the pearls that we see nowadays, we would discover that a fair share of them, even among the expensive ones, came from the Mississippi River or its tributaries. Pearl hunting in these localities has become an established business, and regular pearl prospectors are examining rivers and creeks, with a view to locating beds of mollusks that may contain valuables. Attention to the rare pearls to be found in these streams was first called about twenty years ago, when large numbers of pearl-producing mollusks were found in a small creek in Dane County, Wisconsin. The farmers began searching the beds of streams with such success that thousands of pink, purple, and blue-tinted treasures were sold, bringing in a profit of many thousands of dollars. The excitement that prevailed at that time gradually died down, but enthusiasm has broken out again in localities bordering on the Mississippi.

There is a fascination about the business that smacks strongly of speculation, for a man may find any time a gem that may mean a fortune. The men who live this outdoor life are rugged and healthy, and each carries a tin box, which in one season may become the receptacle for holding thousands of dollars' worth of large and small pearls. The pearl hunters have learned to be experts in valuing their finds, and few gems sell at small prices. Generally they are sent East to lapidaries to be valued, and they are sold at once, for the pearl hunter knows that he does well to avoid the "middleman," who is sent out by eastern firms to gather the "finds." Some pearls are sold for a thousand dollars, and a necklace twenty-eight inches in length, made of small Mississippi pearls for the great singer Nordica, who desired a souvenir of Minneapolis, cost two thousand dollars.

Pearl hunting is an exact science, and the successful hunters are skilled in the business. Usually the prospector has a boat, which he allows to drift with the tide. Behind this is fastened a long pole, to which is attached hundreds of lines with bait on the ends. The mollusks close their mouths over these with tenacity, and as they are hauled in as soon as the lines are filled, many bushels are obtained daily. This is the easiest part of the process. The next operation is to open them, which if done with an oyster knife is so laborious it lives long in the memory of the novice. On this account most prospectors either steam the mollusks over a mild fire, or spread them out in the sun to slowly dry, when the two parts of the shell separate readily. The exciting moment comes when the contents of the shell is divulged, for much or nothing hangs on the revelation.

In fact, this insignificant-looking, dirty clam that may contain a treasure of value is an object of interest in itself. Content to lie in almost any kind of water, living on animalcules, very prolific, and a pearl producer, he travels slowly back and forth from mid-stream to shore unless he is gobbled up by the muskrat, who loves him dearly and eats him, pearl and all. The pearls are always near the shells, and can be squeezed out of the meat, with the fingers. Sometimes they are found loose in the shell, and at other times they are attached to it. If loose, the chances are that they may fall out, and good pearl hunters on this account search the bed of the stream, and even dig up the dirt to see what will "pan out."

In the early days of the industry, the slugs or small pearls were thrown away, but now they are kept and sold by the ounce or separately. These are always in the meat, and sell from two to five dollars. New processes in setting jewelry have made them in demand. Contrary to general belief, the expensive pearls are not always round or oblong in shape. Many fine specimens are "baroques," that is, they assume grotesque forms, a fact that can be accounted for by their origin, for scientists tell us that a pearl is really a malformation caused by some foreign substance finding entrance to the shell, and irritating the mollusk to such an extent that he exudes a liquid, which hardens and eventually becomes a precious pearl.

The prospector moves from one part of the stream to the other as soon as one mollusk bed is devastated. Some beds seem to contain more pearls than others, but it is the size and thickness of the pearl that make it invaluable for some articles of jewelry, and lapidaries in our large cities are using them freely. If any criticism is to be made, it is that they lack the yellow tint of the Oriental product. Many sell for high prices, however, and the black pearls which are occasionally found are exquisite.

To the casual observer, pearl hunting seems the easiest way in the world to earn a living, but it must be remembered that not one in fifty of the right species contains a pearl, and many mollusks are so light colored that they are known to be valueless, and are thrown away without being opened. It is a hit-and-miss sort of business, into which many start. Those that remain to the end get a good living, and every summer finds so many engaged in the work, that pearl hunting has become one of the established means of livelihood in the Mississippi Valley.

SCIENCE NOTES.

In a paper presented to the German Physical Society, F. Meyer treats of the permeability of argon for the ultra-violet rays. He uses an apparatus which is the same as he employs for ozone researches and is on the same plan as the photo-electric photometer devised by H. Kreussler. A glass tube 8 inches long and 2 inches in diameter, closed at the ends by quartz plates, is used as an absorption tube. After filling the tube with a mixture of argon and nitrogen, the author measures the extinction of the radiation by alternately inserting or removing the gas tube. The results he obtains show that argon is quite free from appreciable absorption for ultra-violet rays between $\lambda = 186$ and 300. In any case the absorption does not exceed 3.2 per cent under the conditions of the experiment. As the ordinary air contains about 1 per cent of argon, the latter cannot play any important part in the absorption of the sun's rays having short wave-lengths. Accordingly, we must abandon Hartley's hypothesis, which holds that the substance contained in the air and to which is due the sudden ending of the solar specter for $\lambda = 293$ is identical with argon.

A new process brought out in France relates to the preparation of a derivative of castor oil which can be mixed with the mineral oils. A product of this kind has been already obtained by distilling castor oil up to the point where it loses a determined weight, and stopping the distillation before a product of gelatinous appearance is separated out. The present process, which avoids the losses coming from the distillation and also suppresses the disadvantages which are well known in connection with the dry distillation of oils, consists in heating under pressure the oil to be treated. To carry this out the oil is heated under a certain pressure in a tight boiler until it becomes capable of mixing in all proportions with the mineral oil. It is recognized that the best results are obtained with a temperature of 260 to 300 degrees and a pressure of 4 atmospheres by keeping up the heating for some ten hours. Then the boiler is left to cool completely before it is opened. The product which is thus obtained can be mixed directly with the mineral oils. Observations which have been made up to the present also show that by operating in a closed vessel we avoid all danger of forming a gummy product from the castor oil.

L. Sindet, of Paris, finds that certain metals such as copper when placed under constantly aerated water in the presence of iron act to increase the oxidation of the latter, and that others like tin, lead, zinc, aluminium, and magnesium keep back the rusting of the iron just as alkaline carbonates do. Among the bodies which prevent the rusting of iron, arsenic holds the first place with its compounds. In presence of aerated water they furnish arsenious acid and perhaps sub-oxide of arsenic As_2O_3. Using arsenic in large quantities sometimes the oxidation of the iron is entirely stopped, or again it is only slowed up. Arsenic acid, arsenites, and the alkaline arsenites at 1 per cent strength completely stop the rusting. Orpiment (sulphide of arsenic) gives also a strong effect. Wishing to apply his researches to the study of the causes of rusting of tinned or galvanized iron cans which are used to carry denatured alcohol, he finds that the carbureted alcohols containing 50 per cent of light benzine have a great activity in the production of rust. Benzine having an equal volume of alcohol added to it appears to triple the speed of rusting. Aldehyde, ethyl or methyl acetate do not provoke the oxidation, but they attack the zinc, the tin, then the iron of the vessels, and it is the acetates of zinc, tin, or iron from the decomposition which begin the rusting of the iron, especially in the presence of benzine. Although arsenic, etc., totally stop the oxidation, and this during several months of contact, it is evident that we could not use them here, seeing that even though the alcohol dissolves but traces of arsenic, the latter is oxidized in the liquid and the products of the oxidation are more solid than the arsenic itself. He was able, however, to give a steel sheet a surface cementation by arsenic and it did not rust, while a non-treated sheet exposed at the same time to moist air became entirely covered with rust.

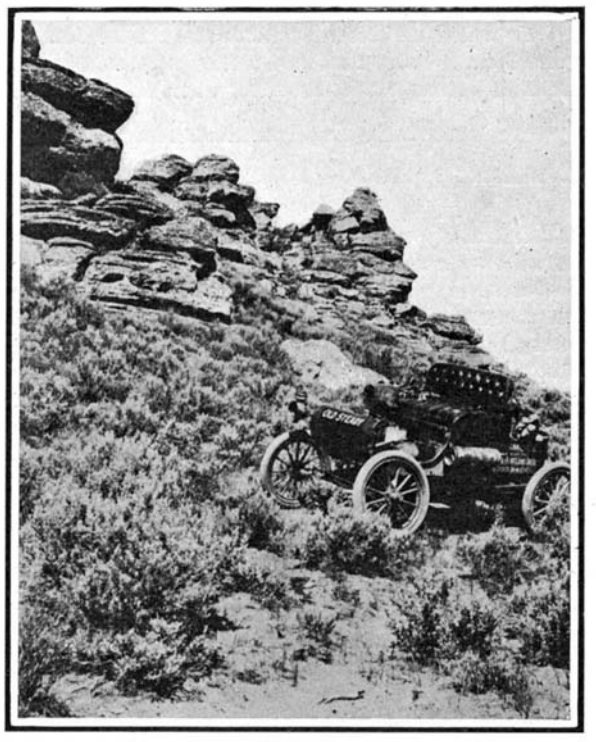
CROSSING THE CONTINENT BY AUTOMOBILE.

There can be no question that the idea of a transcontinental automobile trip was considered by motorists almost as soon as this sport began to assume its prominent position in America. Apparently the first serious attempt which has been recorded was that made by Alexander Winton and Charles Shanks in a Winton car in 1901. This expedition ended unsuccessfully, for after the Sierras had been overcome with difficulty, the sands of the Great American Desert were found to present an unsurmountable obstacle. It was not until 1903 that the continent was actually traversed from ocean to ocean in a motor car. The first successful machine was a Winton touring car carrying Dr. H. Nelson Jackson and Sewall K. Crocker, a professional chauffeur. In this year no less than three parties were able to perform the journey, the other two trips being made in a Packard car and an Oldsmobile runabout, respectively.

Dr. Jackson and Crocker left San Francisco on May 23, in a double-opposed-cylinder touring car of 20 horse-power. The route from San Francisco lay northward along the Sacramento to Redding at the upper end of the valley and thence into lower Oregon, striking boldly across that State and then along a course over the Rockies entirely off the line of all railroads and one that fairly bristled with difficulties. The most annoying troubles were often the minor ones; for not only were these very frequent, but they were of great diversity as well. At only one place did the travelers run out of gasoline, and on this occasion the unhappy Crocker walked 29 miles to procure a fresh supply. At one time they were without food for thirty-six hours and were indebted to a lone but friendly sheep herder for a generous meal. A block and tackle with which the travelers had provided themselves proved invaluable in rescuing the machine from sand, mud, or streams which had been "rushed" unsuccessfully. The steep, rough, and bowlder-strewn grades were overcome one after the other, though the narrowness of the roads, or rather trails, necessitated the most careful driving. A very difficult portion of the journey was that between Redding and Pocatello, Idaho. At Caldwell, in that State, a third person was added to the party in the shape of "Bud," a bulldog, who soon became an expert autoist and a pleasant companion.

As was repeatedly found in later trips in the West, the deeply worn ruts of many of the roads gave almost as much trouble to the low-built cars as the sands. Frequent stallings in mountain streams were no unusual occurrences, but, on the whole, fairly good time was made in crossing the mountains, notwithstanding the loss of a set of ball-bearings from a front wheel with subsequent inefficient repairs by a wayside blacksmith. Travel through the "Bad Lands" was rough in the extreme, as the roads, almost impassable originally, had been rendered still worse by recent cloudbursts. The hardest climb was over Elk Mountain in Wyoming. The stretch through Laramie and Cheyenne, clear across the great plains to the Mississippi, was monotonous, but not very troublesome. From Omaha to Chicago, following the general line of the Chicago and Northwestern Railway, and thence through Cleveland, Buffalo, and Albany, to New York, the journeying was good, and was accomplished pleasantly and without much difficulty. So, on July 26, 1903, with the arrival at the great eastern metropolis, was completed the first automobile journey across the American continent, thus adding one more to the number of the expeditions, beginning with the ox-wain and the mule-team, which started nearly a century ago.

Of the three transcontinental trips made in 1903, the journey of the 12-horse-power, single-cylinder Packard, with E. T. Fetch as driver and M. C. Krarup as observer, was the most direct and central between San Francisco and Denver, through California, Nevada, and



"Old Steady" in the Bad Lands.

Utah. The start was made on June 20, and the journey was completed on August 21, in a wild night drive into New York city. The entire time on the road was 62 days, including a four-day stop at Denver for rest and necessary repairs. The car was of the regular stock type, and with two people aboard weighed nearly 3,000 pounds. Despite the severe strain to which the mechanism was constantly subjected, the interruptions due to breakdowns were trivial. The course, east of Denver, lay through Omaha, Chicago, Cleveland, Buffalo, and Albany.

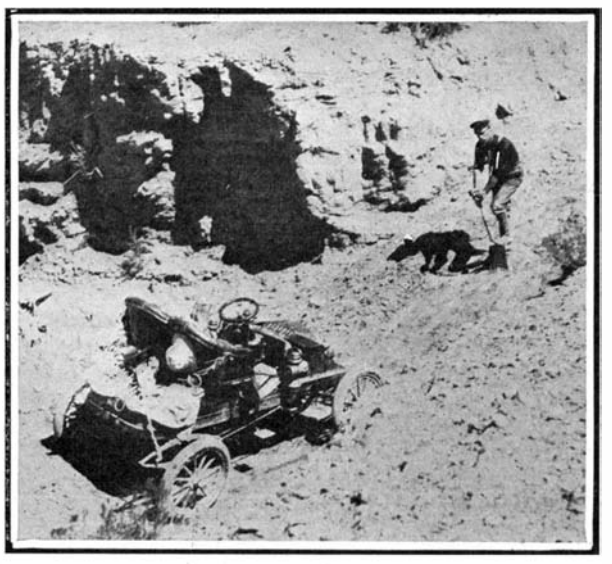
Crossing the Sierras from Placerville was often exciting, particularly the descent from the summit of the divide to Lake Tahoe, about 8,000 feet below, where at one point the machine descended 800 feet in two miles, practically sliding that distance in 9½ minutes under brakes. The troublesome sand in Nevada was successfully combated by using two 24-foot strips of canvas to give traction in the worst places. The alkali marl and innumerable washes encountered in the 300-mile stretch across the Humboldt Valley taxed the endurance of the car and travelers to the utmost. Even more annoying were the ravines and gulches of the desert, and here further trouble was caused by the depth of the ruts, the higher middle portions of the road frequently lifting the wheels of the low-built car clear off the ground. The tough sage brush not only whipped off the canvas under the engine, and the paint from the car body, but completely wore away, as well, the tough wooden handle of a shovel strapped underneath. The steep sides of many ravines were climbed by "jumping" the car by fly-wheel momentum. The worst stretch of rocky, tortuous, and bowlder-strewn road was encountered in Soldiers' Canyon, Utah.

The hardest portion of the trip was over when Denver was reached, though beyond that city barbed-wire cattle fences and irrigation ditches were often annoying. Through parts of Nebraska and Iowa the muddy condition of the roads made the travel almost amphibious, but through Illinois to Chicago, the conditions were excellent. From that city to New York, little trouble was found beyond occasional muddy stretches, and during this part of the trip a good daily average was maintained.

The third journey of the year, the remarkable trip in the little single-cylinder Oldsmobile, was made by L. L. Whitman and E. L. Hammond, who left San Francisco on July 6, bearing a letter from Mayor Schmitz of that city to Mayor Low of New York. The machine was of the regular 5-horse-power runabout type, and carried, besides the occupants, only the most necessary articles. The road lay through Sacramento, Placerville, and Carson City to Reno, and was followed in a leisurely manner, no attempt at record time being made. Ogden, Utah, was reached after a hard struggle with the Great Desert of Nevada, which entailed considerable suffering from the alkali dust. During runs, which would last entire days, nothing was to be seen but sand and sage brush, but a two days' rest at Ogden thoroughly refreshed the travelers. On several occasions the trail of the Packard party was noticed in the desert sands.

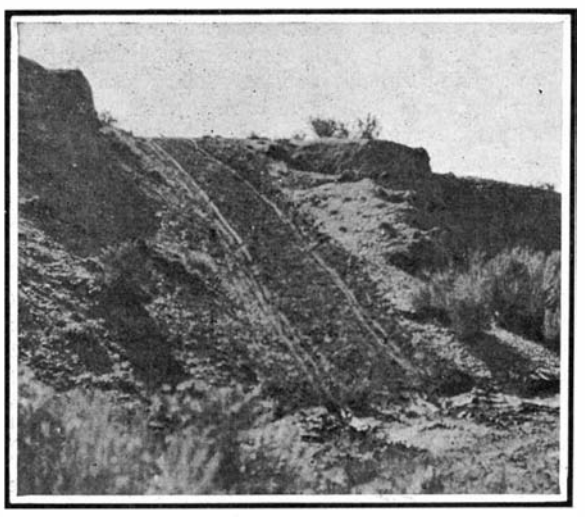
The trip to Denver from Reno lasted eight days, following the line of the Union Pacific Railway through Wyoming. This portion of the route was extremely difficult and after passing through Webber Canyon the terrible roads, rocks, washes, and alternate adobe mud and sand gave a great deal of trouble. Some good roads were found over the Laramie plains, but otherwise it was almost necessary, at times, to make the road. The Rockies were crossed amid clouds and rain, and to Omaha the journey was enlivened by continuous rains and seas of mud. A nine-day wait at that city for better weather conditions proved to be of advantage, for with drier roads, the 600-mile run to Chicago was made in four days. The mud was still bad, however, and the season seems to have been one of exceptionally heavy rains. From Detroit to New York the conditions for travel were far better, and in one afternoon 125 miles were covered. The city and the Atlantic were reached on September 17, after days and weeks of untiring effort. The travelers were enthusiastic about the machine, which was found to have stood the grueling journey splendidly.

The transcontinental



Preparing the Way for the Franklin to Climb Out of a Canyon in Wyoming.

Looking Over the Packard in the Desert Near Winnemuca, Nevada.



A 50 Per Cent Grade 100 Feet Long.

Navigating Through Iowa Mud.

INCIDENTS AND SAMPLES OF ROAD EXPERIENCED IN A TRIP OVERLAND ACROSS THE CONTINENT

trip accomplished by L. L. Whitman and C. S. Carris, in a 10-horse-power Franklin car, in 1904, was remarkable in several ways, primarily as this was the first

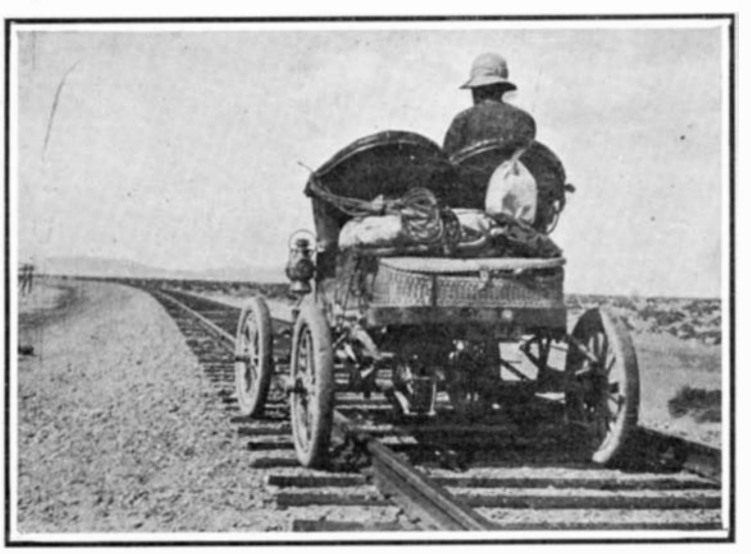
A Western Hostelry, Cottonwood Ranch, Idaho.

The Reo Experimenting. A Combination of Sand and Snow in Central Oregon.

air-cooled car to perform this arduous journey, and as the entire time between start and finish was less than 33 days, cutting the previous record of 61 days nearly in half. The start was made from San Francisco on August 1, in a regular four-cylinder stock car, and on September 3 the wayfarers entered New York city, having made the excellent daily average of 155 miles, the highest day's run being 325 miles. The entire journey was performed without serious accident of any kind, and at the finish the machine barely showed even the slightest evidence of the numerous hard knocks and the unmerciful driving it had undergone. The most difficult portion of the trip, naturally, was that which included the crossing of the Sierras, the Rockies, and the deserts. The Sierras were crossed through Emigrant Gap, from Colfax to Reno, and here the roads were terrible. At one point a descent of 1,200 feet in one mile was accomplished. From Reno through Utah the roads were almost a negative quantity, and the deep sand, canyons, and gulleys gave the travelers a hard time of it. The performance of the air-cooled motor in the blazing heat of the desert was splendid, 600 miles of this Sahara being crossed in seven days. Through Wyoming the course followed the Northern Pacific Railroad, and was difficult in the extreme. At one place, while running at full speed, the rear axle of the car struck a concealed sawed-off telegraph post, and this resulted in a dead stop, which precipitated the occupants of the car over the dashboard. Strangely enough, the only damage caused by this accident was a bent truss rod. Good roads were found across the Laramie plains, and the descent through the Rockies was safely concluded. Good weather permitted record speed to Omaha, and from there to the Atlantic the conditions were excellent, so that this portion of the trip was a mere pleasure jaunt.

An interesting tour was that of the two Oldsmobile runabouts from New York to the Lewis and Clark Exposition last summer, for not only was the journey made by a partly new transcontinental route, but the two machines were racing for a prize of $1,000 besides. "Old Scout," driven by Dwight D. Huss and Milford Wigle, reached the goal first, June 21, followed just one week later by P. F. Megargel and Barton Stanchfield, in "Old Steady." The cars, which were of the ordinary runabout type, left New York May 8, and remained in company until Omaha was reached. Two weeks' rain had made the roads across Illinois, Iowa, and Nebraska almost impassable, and the cars were forced along through the mud under great difficulties. The distance from Omaha through Cheyenne to Laramie was safely accomplished, but the journey from there to Boise, Idaho, appears to have been more of an athletic contest than a road race, as to begin with the roads were usually conspicuous by their absence, or, if present, almost beyond description. Through Idaho and Oregon they encountered the best roads west of Chicago, though there was some thrilling traveling across the Cascades. The time of the winning car was 44 days, 40 days being the actual running time.

The Packard Ready for the Mountains or the Desert.

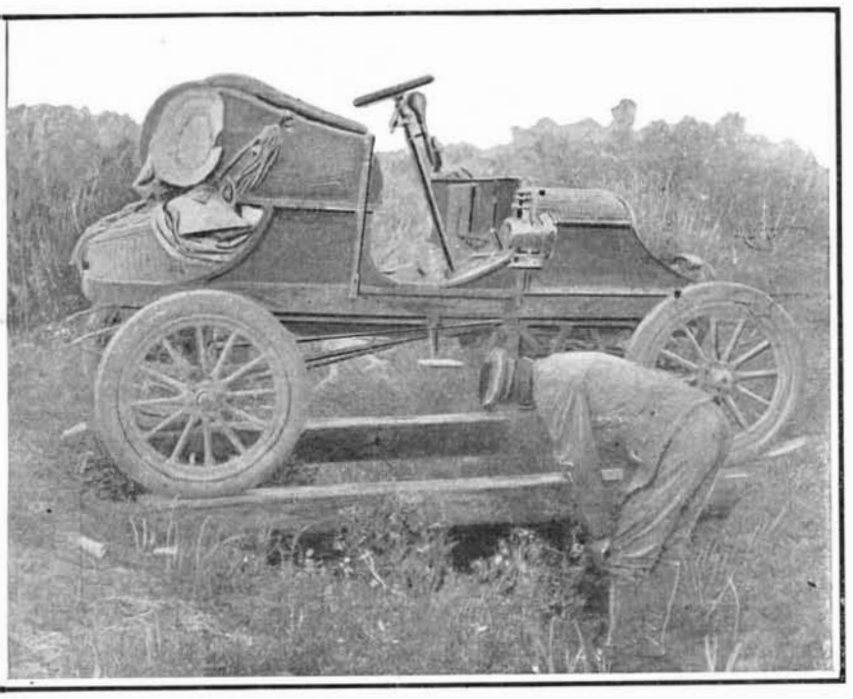


Rough But the Last Resort in Nevada.

The first round trip from ocean to ocean and return ever attempted was that undertaken by Percy F. Megargel and David Fassett, who left New York in the 16-horse-power double-opposed cylinder Reo touring car "Mountaineer," on Saturday, August 19, 1905. The Atlantic-to-Pacific portion of the trip has been successfully concluded, and the travelers are now on the return journey from San Francisco.

From New York westward to Wyoming the journeying was under excellent conditions, and 100 miles a day was easily covered. Crossing Wyoming the sand was often bad, especially in the Red Desert, and sand tires with which the "Mountaineer" was provided were very useful. The deep snow and terrific gales of the Rockies made the six days' travel over the mountains extremely dangerous, while at Bitter Creek a four days' delay was caused by an 8-foot rise of the water after heavy rain. Despite the hard going from Cheyenne the party reached Portland safely on November 10. At the present writing the tourists are nearing Albuquerque, New Mexico, on the southern return trip from San Francisco. This part of the trip has been far more thrilling and difficult than that to Portland. Coming over the Cajon Pass in California, the travelers had a very narrow escape when the car, skidding on a sandy road, turned over completely and rolled down a steep embankment though strangely enough, without material damage to mechanism or passengers. The trip across the Great Desert was enlivened by a fierce sand storm. In the Arizona Mountains the snow was very troublesome, and near Flagstaff the travelers nearly perished in a terrible storm, being without food and gasoline for 36 hours. They were

An Unfortunate Investment in Illinois Real Estate.



Temporary Bridge of Railroad Ties Near Bitter Creek, Wyoming.

CROSSING THE CONTINENT BY AUTOMOBILE.

rescued by a search party seeking a lost ranchman, whose body was later found within a mile of the Reo-ites' camp.

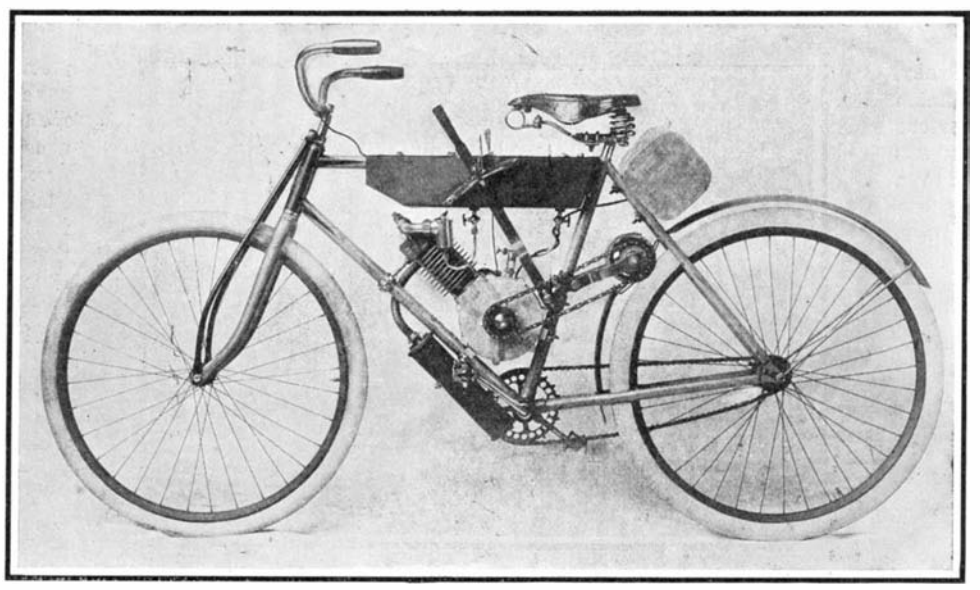
The brief summary given above of cars which have crossed the continent would not be complete without mention of the trip made in 1904 by Mr. Charles T. Glidden in his English Napier. This machine ran to St. Louis in the tour to the Exposition, and thence to Minneapolis, Minn., where flanged wheels were placed upon it, and it completed the trip to the coast on the railroad track. For pleasure purposes this method of making the trip would seem to be ideal. But from a sporting and machine-racking point of view, the journey as accomplished by the six American cars was immeasurably superior. The record-holder, the air-cooled Franklin, is the only car fitted with a four-cylinder vertical motor, as well as the only air-cooled automobile that has ever made the trip. The other machines, also, are all of typical American construction, having horizontal single- and double-opposed-cylinder engines. Of the six successful cars, four are light runabouts, and three of these are of the same make. The American light car has thus proved itself the stanchest and most speedy of machines in a test such as has never been undertaken by European makers. Not only this, but the trip has also been made twice by motorcyclists—first in 1903 by George A. Wyman on a Yale-California machine, and second, last fall by W. C. Chadeayne on a Thomas Auto-Bi. The time of the former was 48½ days, and that of the latter 47 days, 11 hours, and 35 minutes.

A MOTOR EQUIPMENT FOR BICYCLES.

Our illustration shows a compact power outfit for converting an ordinary bicycle into a motor-driven machine. This outfit can be readily attached by anyone with the aid of a few ordinary tools, as all the parts are clamped to the frame with bolts and nuts, and there is no brazing or soldering required. As can be seen from the cut, the motor drives, by means of a chain, a rubber-covered friction wheel placed in the rear triangle of the diamond frame, directly over the bicycle wheel. This friction wheel is carried in a fork pivoted upon the vertical post, and adapted to be pressed against the tire by means of the long lever shown in front of the seat. The machine is started with the friction wheel raised, and when the rider has it fully under way, he can throw in the friction, start the motor, and proceed under its power. In coasting or when riding in a crowded street, the motor can be stopped and the friction wheel raised. This is a very advantageous arrangement, as it is not necessary to run the motor except when it is in use. The whole outfit weighs but 45 pounds, and, with a 2-horse-power motor, the machine will carry its rider about 30 miles an hour.

A LIGHT FOUR-PASSENGER RUNABOUT.

The single-cylinder runabout with a box behind which opens and forms an extra seat, is one of the new light cars for 1906. In our illustration, Mr. R. E. Olds, the inventor, is shown at the wheel. This car is fitted with a 4¾ x 6 engine, two speed, planetary transmission, and inclosed expanding ring brakes on the rear wheels. It is an extremely powerful little machine, capable of carrying four people 25 miles in an hour with a consumption of but one gallon of gasoline. The chassis resembles closely that of the Reo touring car, which has two 4¾ x 6 cylinders. The layout and construction of both cars is the same. The positive drive of the water pump directly from the engine crankshaft is a commendable feature, as is also the covering of the valve stems and springs with sheet-metal protectors to keep out dirt. The engine and transmission are mounted on a separate frame which is fastened in place on the main frame. The valves and spark plugs are in chambers placed above the cylinders and thus out of the way of oil. Individual carbureters and spark coils are used on the touring car, which is also fitted with a mechanical oiler. The Reo "Mountaineer"—the car which has crossed the continent and is expected back in time for the automobile show—is one of the regular double-opposed cylinder touring cars. The Reo Company also makes a coupé on this same chassis, besides a new light four-cylinder touring car having three-speed transmission, shaft drive, a new type of universal joint, illustrated on page 38, and other interesting features.



A 2-HORSE-POWER MOTOR WITH FRICTION DRIVE FOR CONVERTING AN ORDINARY BICYCLE INTO A POWER-DRIVEN MACHINE.

A LIGHT AND SPEEDY RUNABOUT.

The light-weight runabout shown below is the new 10-horse-power Maxwell car intended for light and high-speed work. This machine is fitted with the usual double-opposed-cylinder Maxwell motor, placed crosswise beneath the bonnet and having a two-speed planetary transmission in the same case with the cranks of the motor, which makes it impossible for any of the movable parts to get out of line. The motor, which is a 4½ x 5, has been considerably improved over that used last year. The heads and valves are water-cooled, which enables a higher compression to be used. The transmission is fitted with a multiple disk clutch and runs in oil. The same automatic compression oiler is used as was employed last year on the Maxwell cars, and the rear axle and bevel gear drive are also identical. The propeller shaft has two universal joints, packed in grease. The rear axle is mounted on roller bearings. The side thrust of the bevel driving pinion is taken up by a blank roller of the same size as the driving pinion, and which is fitted against the smooth bevel face of the drive gear so as to hold the latter in position. The car is provided with a steel body and pressed steel frame. Its official record of a mile in 1:18 is an indication of what may be expected of it in the way of speed on the level.

The Maxwell-Briscoe Company is another firm to this year bring out a new 4-cylinder 32-40 horse-power touring car. Besides this car, the company also makes a truck and a Limousine body car. The double-opposed-cylinder touring car and runabout, which were so successful last year, will also still be manufactured. The company now has three factories, and is turning out eight different models.

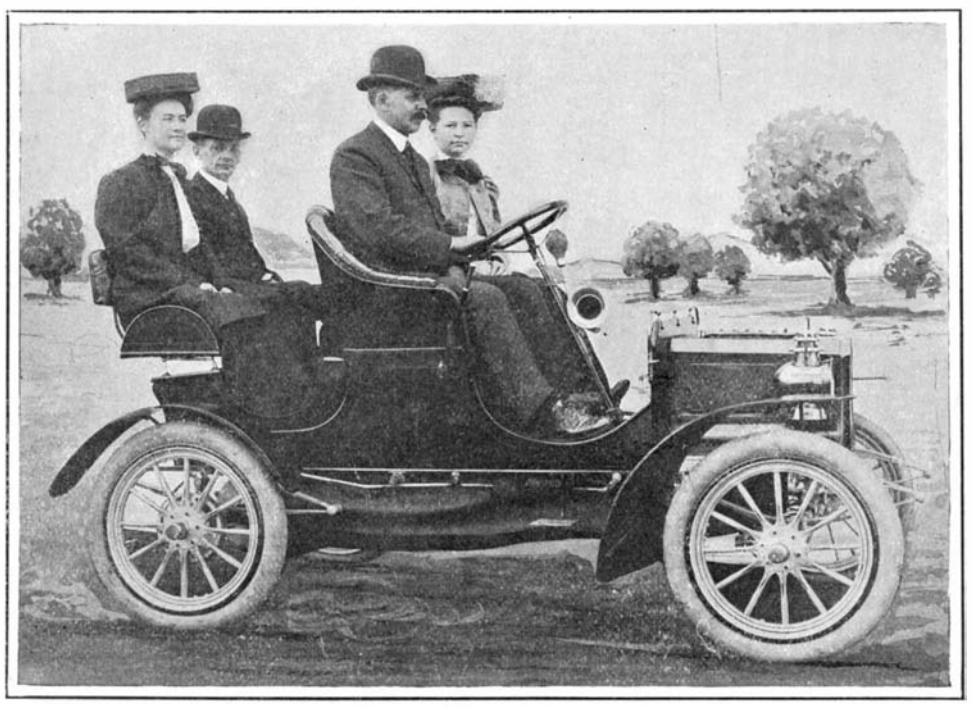
A Motor House Boat.

A luxurious motor house boat is in course of construction for the Marquis de Dion, who is so closely identified with the internal combustion engine of that name. The craft is 124 feet in length, with a beam of 16 feet 6 inches and of shallow draft. The boat will be provided with a sitting and sleeping compartment combined, a dining saloon 20 feet long by 15 feet broad, bedrooms, bathrooms, kitchen, captain's apartment, and quarters for the crew. With this motor water villa the owner intends to tour the various waterways and canals of France, accompanied by automobiles, with which he can indulge in land excursions when he so desires. Later the boat will wend its way through France to Marseilles, and thence round the coast to Monaco, where the owner will winter. The vessel will have a speed varying from eight to nine miles per hour.

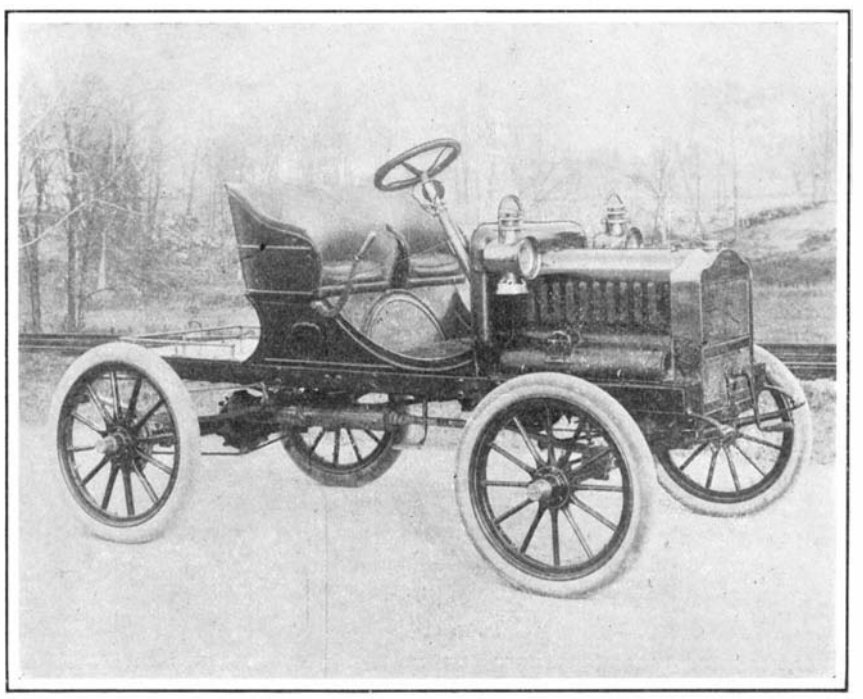
One of the most important moves in automobile building has been made by the American Locomotive Company. It involves the manufacture of the Berliet car in America, on the same plans and designs as are followed in the factory in France.

French workmen in Lyons and American workmen in the United States, working simultaneously, but three thousand miles apart, in the production of automobiles, the parts of which will interchange across the ocean, is a manufacturing accomplishment worthy of note. The French and American workmen might be standing side by side, so closely and exactly do they follow the same standards, templates, patterns, and gages. This is done in the construction of the Berliet car, so that an American-built car may be taken for a tour in Europe, or a Lyons-built car may be brought over for a tour in this country, and repair parts which are sure to fit are available nearby in either case. This will avoid months of such delays as are very familiar to the users of foreign-built cars. This is rendered possible by the use of the metric system and by maintaining the strictest conformity to standards, patterns, and gages and the closest adherence to specifications for material.

A new station for wireless telegraphy, according to the Neue Freie Presse, is being installed at Norddeich, in Germany, on the North Sea. The area covered by its operations will have a radius of over 900 miles, and will include Germany, Austria, Switzerland, France, Great Britain, and Denmark, as well as the greater part of Italy, Sweden, and Norway, and portions of Spain, the Balkan peninsula, and Russia. The station is being equipped with the Telefunken system.



THE NEW 8-HORSE-POWER, SINGLE-CYLINDER REO RUNABOUT FITTED WITH A FOLDING REAR SEAT FOR CARRYING TWO EXTRA PASSENGERS.

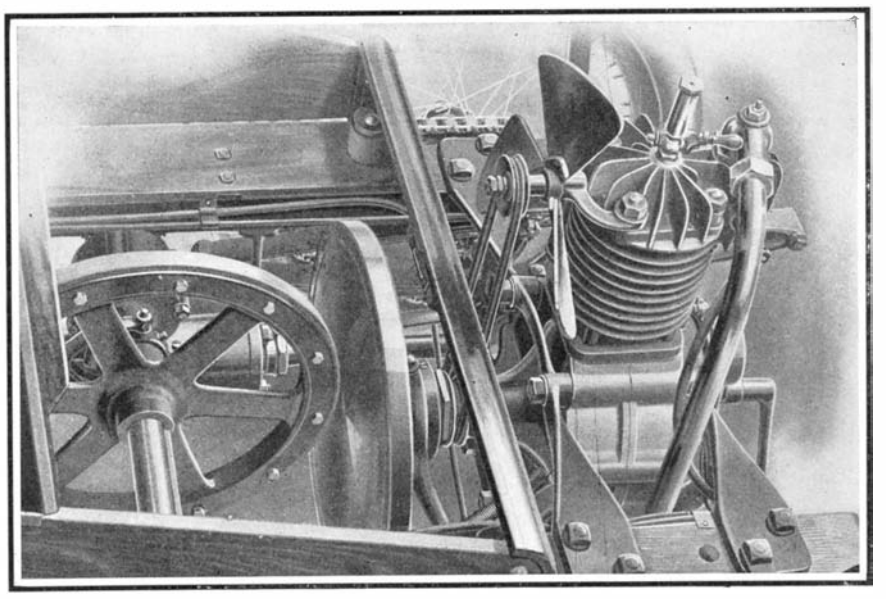


A 10-HORSE-POWER GENTLEMEN'S SPEEDSTER FITTED WITH DOUBLE-OPPOSED-CYLINDER ENGINE AND BEVEL-GEAR DRIVE.

A FOUR-CYLINDER AIR-COOLED RUNABOUT.

The latest application of the four-cylinder air-cooled motor to a light runabout is typified in the Waltham-Orient machine illustrated herewith. In this 1,300-pound car the motor is placed longitudinally under the bonnet with a fan in front to blow on it. A three-speed sliding-gear transmission is placed back of the motor and connected to the usual universally-jointed propeller shaft with a bevel-gear drive at the rear axle. The transmission is so arranged that no gears are in mesh when the car is running on the high speed. This arrangement is shown in the photograph reproduced herewith. For the intermediate and low speeds the sliding member, 4, 5, is moved to the left by shifting fork, *S*, until 5 meshes with 6 or 4 with 3. As rod *S'* (upon which *S* is mounted) is moved, it carries with it slide *G*. A roller on the end of lever, *E*, is set in a notch in this slide. The other end of *E* fits in a shifting collar, 9, of gear, 2, and *E* is mounted on a pivot at its center. As *S* and *G* move to the left, *E* moves a certain distance with them, or until the roller slips out of the notch and rides upon the edge of *G*. The other end of *E* is moved to the right and gear 2 is slid into mesh with gear 1 and held there until the high speed is again engaged. This speed is obtained by locking the left-hand end of the lower shaft to the short right-hand end carrying gear 1, by means of the jaw clutch, *M F*. The drive on the low and intermediate speeds is through 1-2-3-4 and 1-2-6-5 respectively, while the reverse is had through 1-2-7-8-4. Pinion 8 is the intermediate pinion in mesh with 7 and running on a stud attached to the gear case. This transmission has the advantage that all gears on the lay shaft are idle when the car is on the high speed.

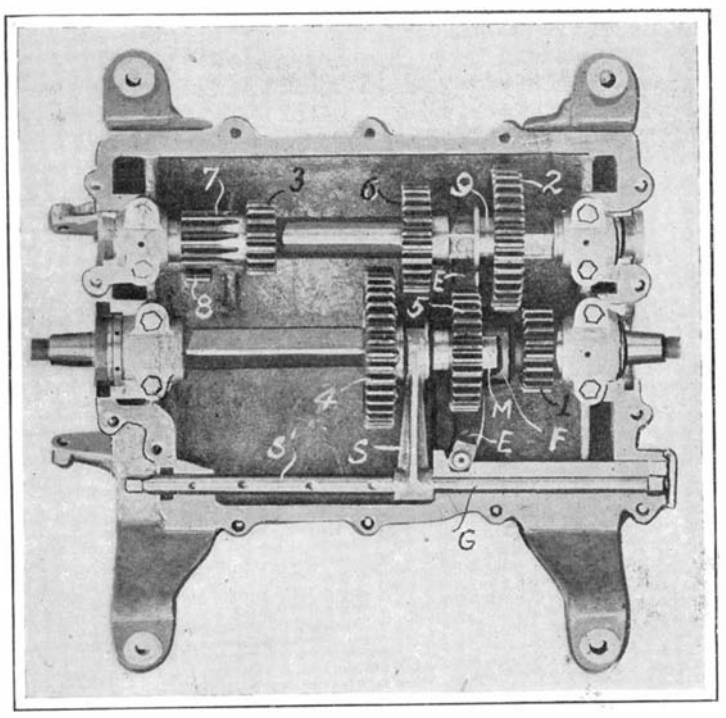
Another cut shows the carbureter with side broken away. The chamber on the left contains the float, which rises as the gasoline enters through the pipe in the bottom, and lowers the needle valve by means of the levers above it, until the gasoline reaches the desired level. The valve is then closed, and it opens slightly to let in the fuel in proportion as it is used. The gasoline is maintained in the spraying nozzle at the level shown. The air, aspired through the lower horizontal pipe, passes up through the hood around the spraying nozzle and out through the hole at the back, which is shown in the cut half closed by the throttle. The throttle lever is seen on top. The horizontal disk above the hood and spraying nozzle has a hole in the center and a ring of smaller holes just within its periphery. It is integral with the spider, *T*, and is held to its seat by the coiled spring shown. When the suction of the motor increases and more air is required, this valve is raised and an additional supply of air beyond what normally passes through the holes, is drawn in. The tension on the spring may be adjusted by the milled nut, *x*, on the top of the carbureter. The engine of this runabout has a 3¼-inch bore and 4¼-inch stroke. It is rated at 16 horse-power. A belt-driven fan running on ball bearings is used to keep it cool. A governor is fitted also. The crankshaft is supported in five long plain bearings. The 72-pound flywheel carries a leather-lined internal cone clutch which is accessible and may be readily removed. The engine is oiled by an automatic sight-feed oiler. Jump spark ignition with separate coils, and storage batteries is used. The commutator has a special wipe contact and is conveniently placed. The car has an 82-inch wheel base, standard tread, and 30 x 3½-inch tires. It will travel 40 miles an hour on a fuel consumption of one gallon per 15 miles.



THE FRICTION DISK DRIVE EMPLOYED ON THE BUCKBOARD RUNABOUT.

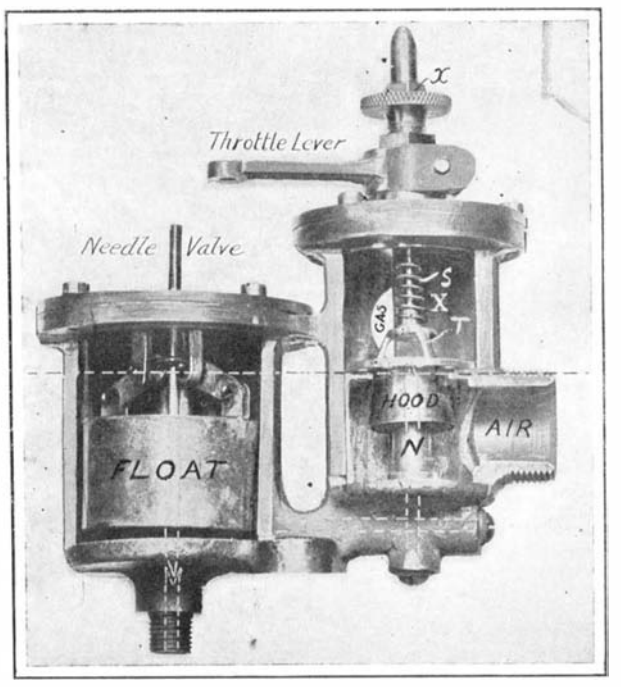
This form of drive has also been used successfully on heavy commercial vehicles and touring cars.

The other car shown is the very light, low-powered runabout, which has been developed from the buckboard originally built by this company. As with the buckboard, the motor is placed at the rear end of the car, being mounted on the frame of the body directly over the rear axle. The motor shaft is placed lengthwise of the car. On its forward end is a large friction disk. A countershaft placed in front of the disk carries a friction pulley at right angles to the latter. By sliding the pulley across the face of the disk any number of different speeds can be obtained. The reverse is obtained by sliding the pulley over to the opposite side of the disk, and any speed from the slowest to the highest can also be had in this direction. The friction disk arrangement is shown in the cut above. The countershaft drives the rear wheels by chains, as shown in the cut below. A fan is placed in front of the motor. The valves, commutators, and spark plug are readily got at from behind.



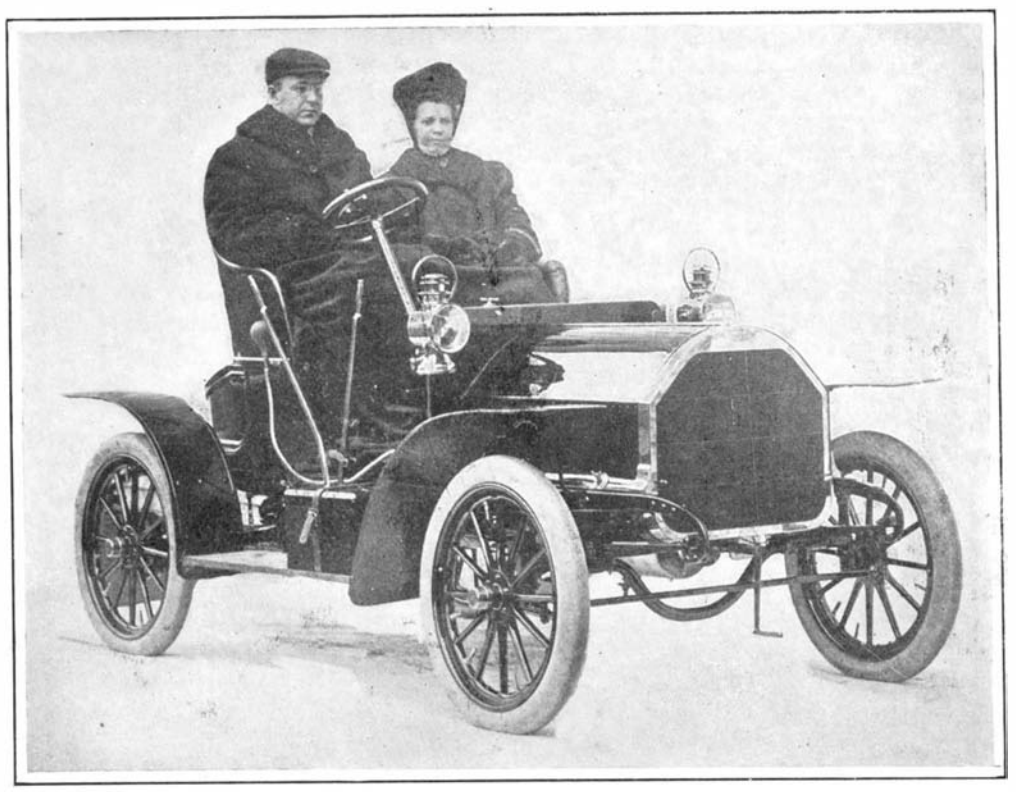
TYPICAL 3-SPEED SLIDING-GEAR TRANSMISSION SHOWING DIRECT DRIVE ON HIGH SPEED.

E. Lever for shifting gear 2. *F*, *M*, Jaw clutch for direct through drive. *S*, Shifting fork for sliding gears 4 and 5. *S'*, Rod with notches, to which *S* is attached. *G*. Notched slide adapted to move with rod *S*.

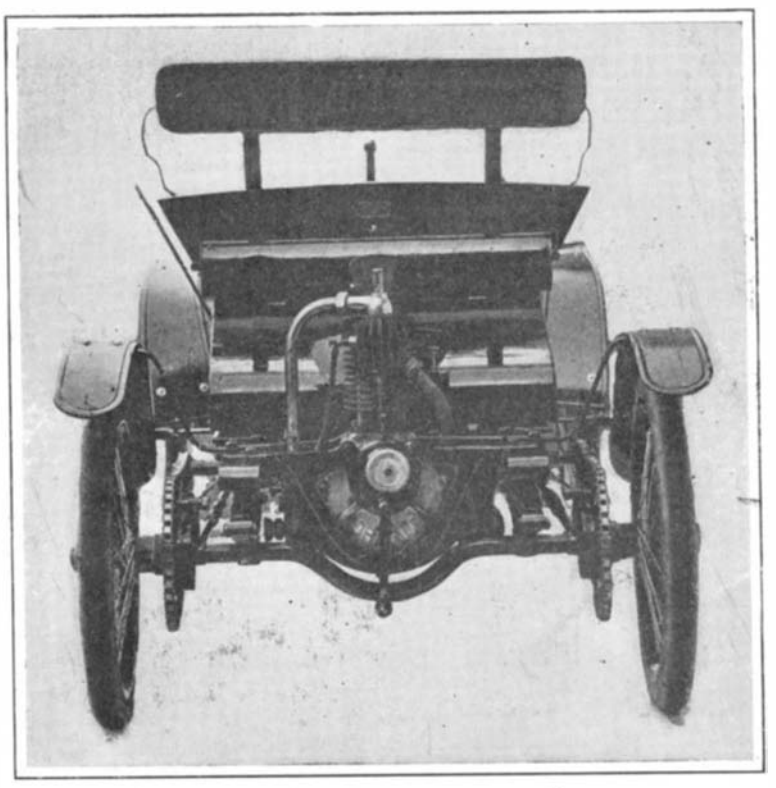


A TYPICAL FLOAT-FEED AUTOMATIC CARBURETER.

N, Spraying nozzle. *T*, Auxiliary air valve. *S*, Adjustable spring of air valve. *x*, Thumb screw for adjusting tension of *S*. *X*, Throttle valve.



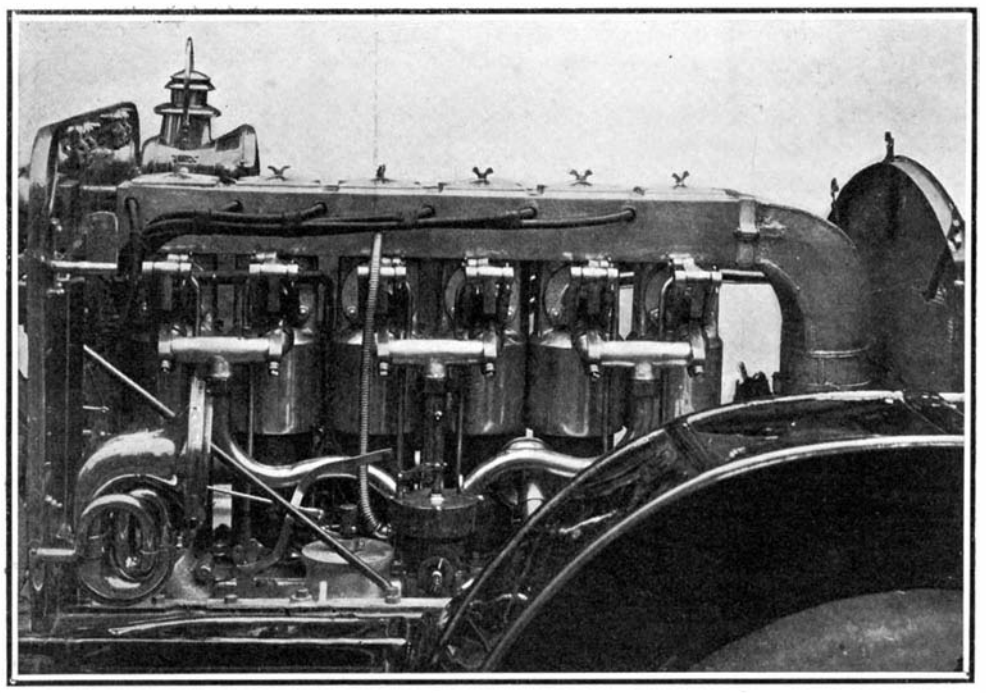
A 1,300-POUND RUNABOUT FITTED WITH A 16-HORSE-POWER, 4-CYLINDER, AIR-COOLED MOTOR.



REAR VIEW OF LIGHT BUCKBOARD, SHOWING DOUBLE CHAIN DRIVE FROM COUNTERSHAFT.

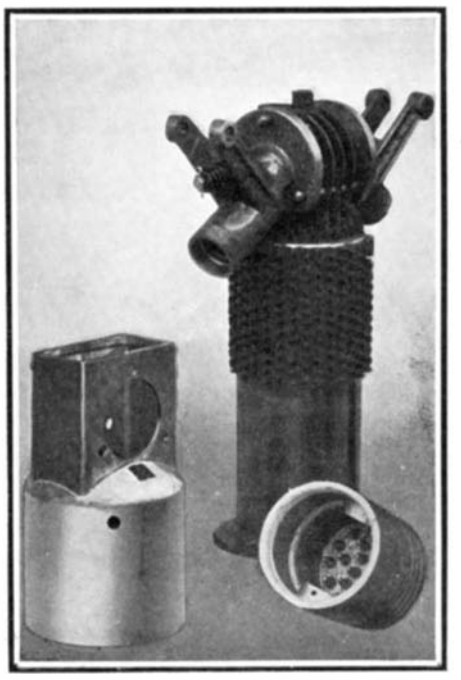
THE FRAYER-MILLER SIX-CYLINDER AIR-COOLED MOTOR.

One of the greatest improvements in automobile motors for this year is the development of the six-cylinder, four-cycle gasoline motor. The Napier Company, of England, was the first to bring out a racer with a six-cylinder motor, and to demonstrate the superiority of the same motor on touring cars. A number of foreign firms, as well as several of the leading American companies, are manufacturing six-cylinder water-cooled motors this year; but the annexed illustration shows a positively-cooled waterless six-cylinder engine of 4 1/16 bore by 5⅛-inch stroke, which is capable of developing 50 horse-power. The cylinders are cast with pin-like projections around the heads, as shown in the smaller cut. The valves are attached to each side of a cylinder head, and the whole cylinder is jacketed with an air jacket of aluminium. Air is blown by a powerful blower, gear-driven from the crankshaft in front of the motor four times as fast as the motor revolves. A pressure of about 2 ounces is produced in the large pipe running over all the cylinders, and this pressure is sufficient to force the cooling air down through the jackets and pins which project from the cylinder walls. So efficient is the cooling, that a relatively high compression—75 pounds—can be used without danger of premature explosions from heat. This system is one of the few in which the motor is positively cooled at all speeds. The car upon which this motor is mounted is fitted with a four-speed, selective-type transmission and bevel gear drive to the rear axle. Non-adjustable ball bearings are used liberally throughout the car, both in the transmission and the rear axle. The wheel base of the machine is 100 inches, and the tires 34 x 4. The difference in smoothness of running between a four-cylinder and a six-cylinder motor is found in the almost imperceptible impulses obtained from the latter, while those of the four-cylinder are distinctly noticeable. Furthermore, the six-cylinder engine is so flexible that the car can be driven at any speed from 4 to 60 miles an hour on the fourth speed gear under throttle control.



SIX-CYLINDER AIR-COOLED MOTOR OF THE FRAYER-MILLER CAR.

A gear-driven blower in front maintains an air blast in the pipe and down through the aluminium air jackets. The spark plugs are in the cylinder heads. Three pipes from the carbureter supply the three pairs of cylinders. Note also the vertical fender from mud guard to frame.

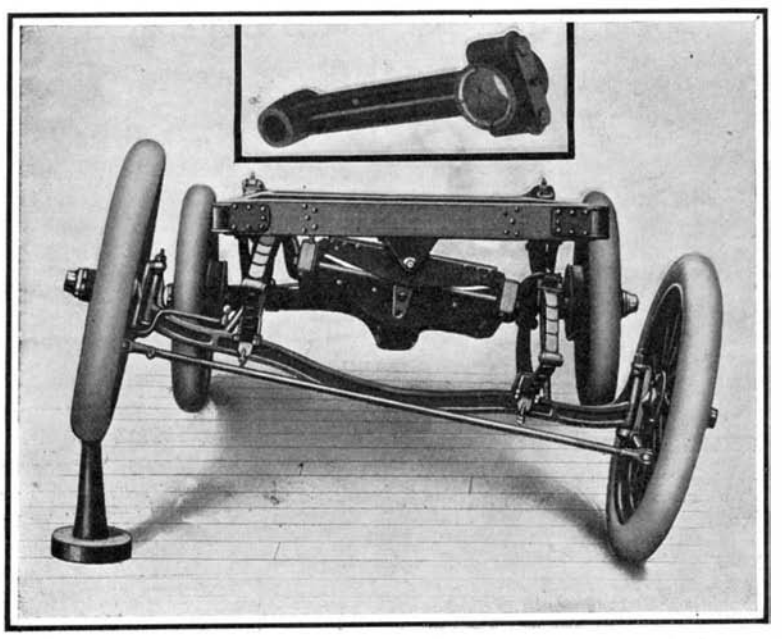


CYLINDER, AIR JACKET, AND PISTON OF FRAYER-MILLER MOTOR.

The cylinder has small heat-radiating pins cast on it, as has also the under surface of the piston head. The valves are bolted to cylinder head. The spark plug in top is got at through hand hole in bus pipe.

THE MARMON AIR-COOLED TOURING CAR.

The main features to be noted about this car are the carrying of the entire power mechanism on an independent triangular sub-frame, the elimination of chains and universal joints, and the mounting of both the body frame and sub-frame upon three pivoted points, which gives it extremely easy riding qualities. The photographs reproduced herewith show the general appearance of the car and motor, and the great flexibility of its running gear. In the end view of the chassis, in which one of the wheels is raised a foot from the ground, is this flexibility noticeable. The front end of the sub-frame is hung from the front springs, while its rear end, which forms the apex of an isosceles triangle, is revolubly mounted on a sleeve extending forward from the differential gear casing on the rear axle. The propeller shaft within this sleeve is supported in a ball bearing back of the driving pinion and in a roller bearing a short distance forward. The cross member of the sub-frame is pivoted at each end; and has rising from its center a pivotal support for the main frame. This pivot allows the latter frame to tilt and assume any inclination given it by the rear springs, which support its other end. A vertical movement of either front wheel does not affect the main frame in the least (as shown in the cut), and it merely causes the sub-frame to rock around its point of support at the rear without any strain to the mechanism this frame carries. A vertical movement of either rear wheel, on the other hand, tips the main frame correspondingly but affects the sub-frame not at all, save to raise its rear end the same distance the rear axle rises in the center. Thus it can be seen that neither frame is submitted to any twisting strains whatever, and that the carriage body is not affected by obstructions passed over by the front wheels. Both frames are of armored wood. The sub-frame consists of an oak I-beam inclosed in steel.

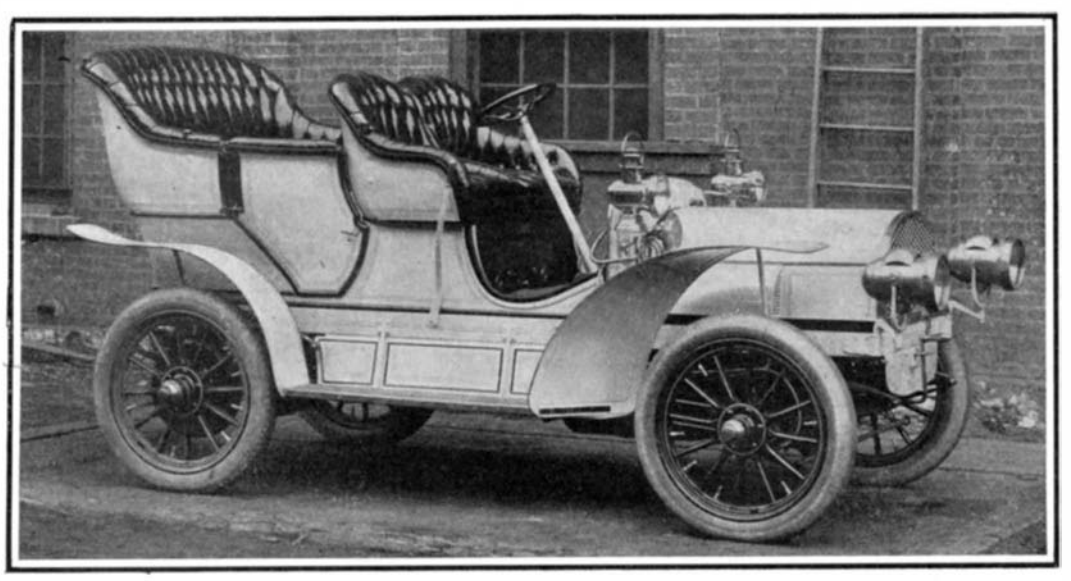


FRONT END OF MARMON CHASSIS WITH WHEEL RAISED ONE FOOT.

As a result of the double three-point suspension, the sub-frame is tipped but the main frame remains horizontal. Small cut shows pipe for carrying forced circulation of oil to wrist pin of motor.

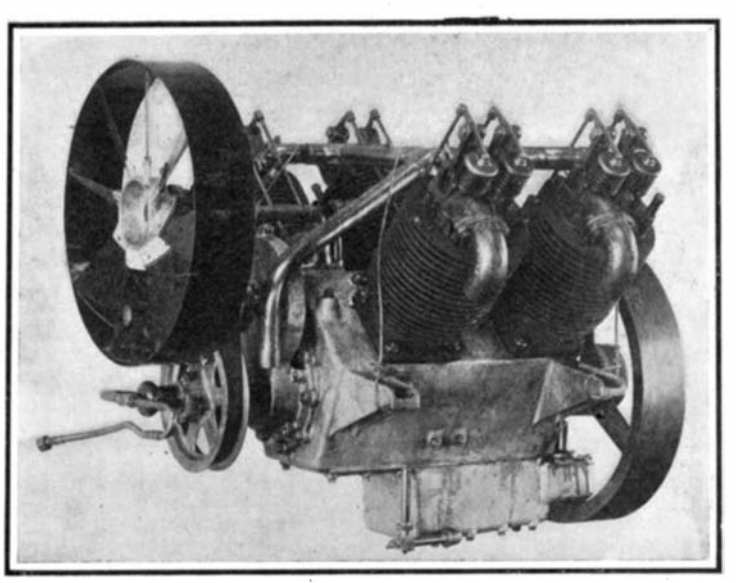
The motor is a 4⅝ x 5½-inch four-cylinder engine with cylinders in pairs set at an angle of 90 deg. It develops 28 horse-power at about 1,200 R. P. M. The valves are in the cylinder heads, operated mechanically, and fitted with large spiral springs. A belt-driven fan sends a powerful draft of air between the cylinders, and a plow within the bonnet diverts it to the heads. The draft produced by the motion of the car strikes the heads directly by passing through openings in the sides of the bonnet. An oil pump in the base of the crankcase forces oil from an oil well through a suitable pipe and stuffing box into the front end of the crankshaft. This is hollow and has small holes opening into all the bearings. The crank pin boxes have corresponding holes connected by straight oil pipes to the wrist pins, so that the oil is forced to all parts of the engine, and a spray of oil, exuding from the bearings, lubricates the pistons. A gage on the dash indicates the oil pressure. The two-speed planetary transmission is carried on the propeller shaft, which is without support between the engine and the foremost of the two bearings that carry its rear end. The transmission is without internal gears. Its three sets of three pinions are each formed from one piece. The clutch and bronze brake bands are large and run in oil. The reverse can be used as a brake if

(*Continued on page* 49.)



THE MARMON AIR-COOLED TOURING CAR WITH ALUMINIUM BODY AND DASH.

Note the fenders between running board and body in addition to those over the wheels.



THE 4⅝ X 5½ MARMON AIR-COOLED MOTOR, SHOWING PIPE CONNECTED TO HOLLOW CRANKSHAFT FOR CIRCULATION OF OIL FROM TANK IN BASE.

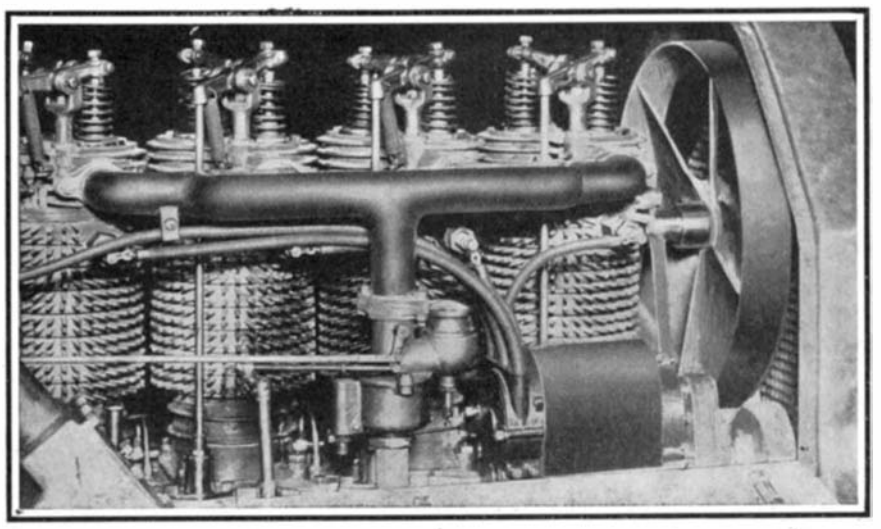
A REVOLVING-CYLINDER MOTOR CAR.

A machine of distinctive design, and having a motor of decidedly original construction is illustrated herewith. This machine showed its capabilities in the Chicago-St. Paul tour last July, when it covered the 500-odd miles through mud and rain in good time, it making the best time of the two air-cooled cars which completed the run.

The motor of this car is similar to the Balzer engine described in our 1904 Automobile Number, the main difference being that the former has its cylinders revolving in a horizontal instead of a vertical plane. The A. F. motor is controlled by variable compression, the charge from one cylinder being almost entirely expelled and sucked into another when the engine is running light. The carbureter is replaced by a gasoline pump which sprays the fuel through a pipe, *P*, into chamber, *C*, containing a leather gas-supply bag from which the gas is drawn to the cylinders through passages, *D*. The mixture is obtained by regulating the stroke of the pump. The spark is advanced automatically according to the speed of the motor. A positive-feed oil pump lubricates all parts of the motor with certainty. A single spark coil with vibrator answers for all the cylinders. The spark jumps outside the motor from the stationary conductor, *B*, to the porcelain binding post, *F*, on the revolving crankcase, whence the secondary current passes through a wire to the plug, *G*. The inlet and exhaust valves are in the cylinder heads, each pair being operated by a single lever pivoted between them and rocked by suitable cams in the crankcase. Auxiliary exhaust ports, *E*, with wire gauze, make a muffler unnecessary. The entire power plant, transmission included, weighs 480 pounds, 230 pounds of which represents the weight of the motor. The revolving part of the motor—cylinders and crankcase—weighs 190 pounds; so that, although there is no flywheel, the effect of a 190-pound flywheel is obtained. The motor weighs only 9 pounds to the horse-power. At a speed of 600 R. P. M. the air rushes over the longitudinal flanges of its cylinders at the rate of a mile a minute. This positive cooling of the cylinders at all speeds and without the use of fans or blowers, is the one chief feature of this car. Because of it, the car can be run at all times and under all conditions without loss of power from overheating. A 5 x 5 five-cylinder motor giving 45 horse-power is the largest engine that has been built thus far, but engines of still greater horse-power could no doubt be made to run successfully.

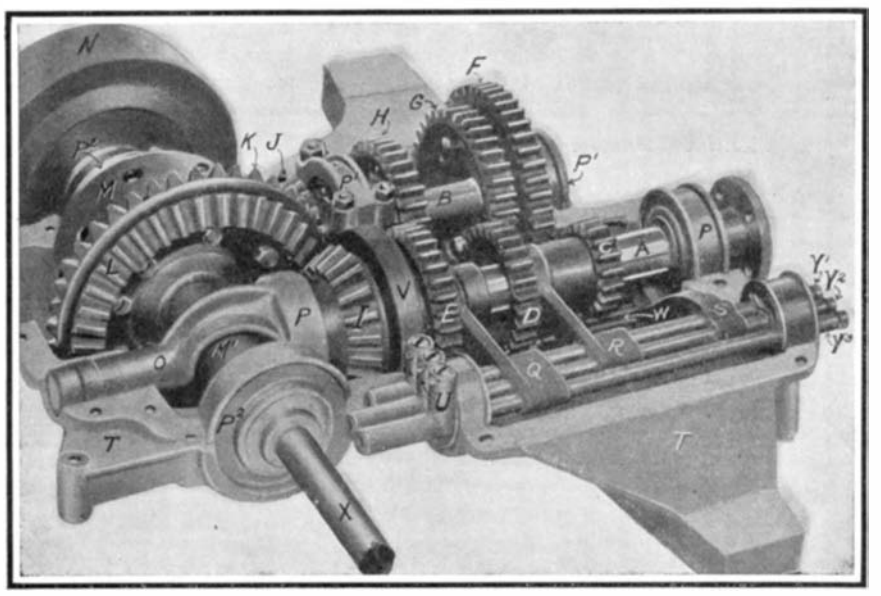
The transmission is of the planetary type giving two speeds ahead and a reverse, but a simple arrangement of sliding gears used in connection with it makes possible the obtaining of two more speeds ahead and another reverse. The countershaft carrying the transmission is directly below the motor and is driven through bevel gears. A single chain from it to the differential on the live rear axle transmits the power.

Because of the light weight of the power plant, the car with its heavy closed body weighs only 2,000 pounds. The steering control levers can be quickly changed to the inside if necessary, and the front seat and footboard be closed. The car is thus an ideal two-passenger car for stormy weather or a five-passenger open car (by letting down the windows) for fair weather.



THE 4¾ x 5½ KNOX 4-CYLINDER AIR-COOLED MOTOR.

Note the auxiliary coil springs on rocker arms of inlet valves; also wires running direct to spark plugs from high tension distributor on gear-driven magneto. The carbureter and fan are also plainly visible.



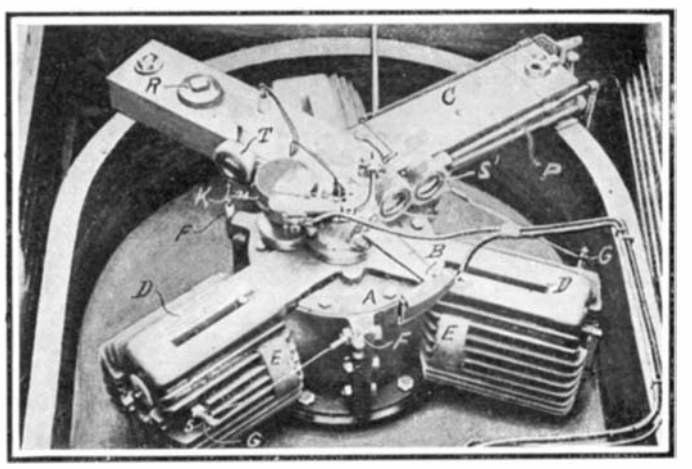
THE NEW MERCEDES-TYPE SELECTIVE TRANSMISSION HAVING A DOUBLE BEVEL GEAR DRIVE.

A NEW FOUR-CYLINDER AIR-COOLED MOTOR AND SELECTIVE-TYPE TRANSMISSION.

A new form of selective-type transmission giving four speeds ahead and a reverse, with direct drive on the high speed, is shown in the annexed cut. The main shaft, *A*, is very large in diameter, and has four integral fluted keys to drive the sliding gear members. It is coupled directly to the clutch shaft of engine and runs in bearings, *P P*, the rear bearing being bolted to the bottom of the case and also braced by arm, *O*, which is arched over the cross shaft to the rear end of case. The second motion shaft, *B*, runs in bearings, *P' P'*, and has gears, *F G H*, rigidly secured on it. The differential gears are of the bevel style and are inclosed in the perforated case, *M*, which has its ends extended from sleeve, *M'*, and runs in bearings, P^2 P^2. Brake drum, *N*, is firmly secured to case, *M*, and has two metal shoes which are applied by a pedal. Two bevel gears are secured to the periphery of *M*. One, *L*, is the direct high-gear drive, meshing with pinion, *I*, and the other is the drive for lower speeds, meshing with pinion, *J*, on the second motion shaft. Bevel pinion, *I*, is integral with internal gear, *V*, and runs on ball bearings on shaft, *A*, except when it is clutched to this shaft by sliding the gear, *E*, into mesh with *V*, by means of fork, *Q*, and shifter bar, Y_3, giving fourth speed on direct drive. On this drive bevel gears, *J* and *K*, and shaft, *B*, are running idle, and gears, *F G H*, are not in mesh. Meshing *E* with *H* gives third speed. By means of fork, *R*, and shifter bar, Y_2, *D* is meshed with *G* for second speed or *C* with *F* for first speed, *C* and *D* being integral. Reverse gear, *W*, is mounted between two supports on the bottom of case and shifted by fork, *S*, and shifter bar, *Y'*, into mesh with *C* and *F* for the reverse motion. Spring-pressed balls in the cases, *U*,

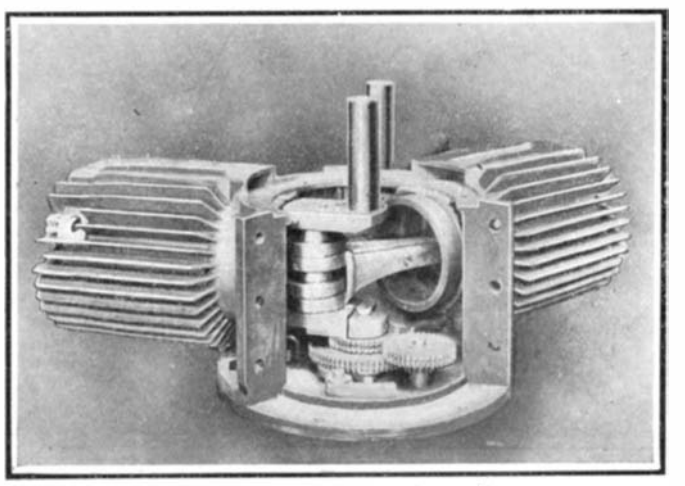
(*Continued on page* 49.)

AN EX-SPEAKER AND A WELL-KNOWN SENATOR READY TO RIDE IN AN ADAMS-FARWELL REVOLVING-CYLINDER MOTOR CAR.



THE MOTOR AS SEEN WHEN BACK COVER IS RAISED.

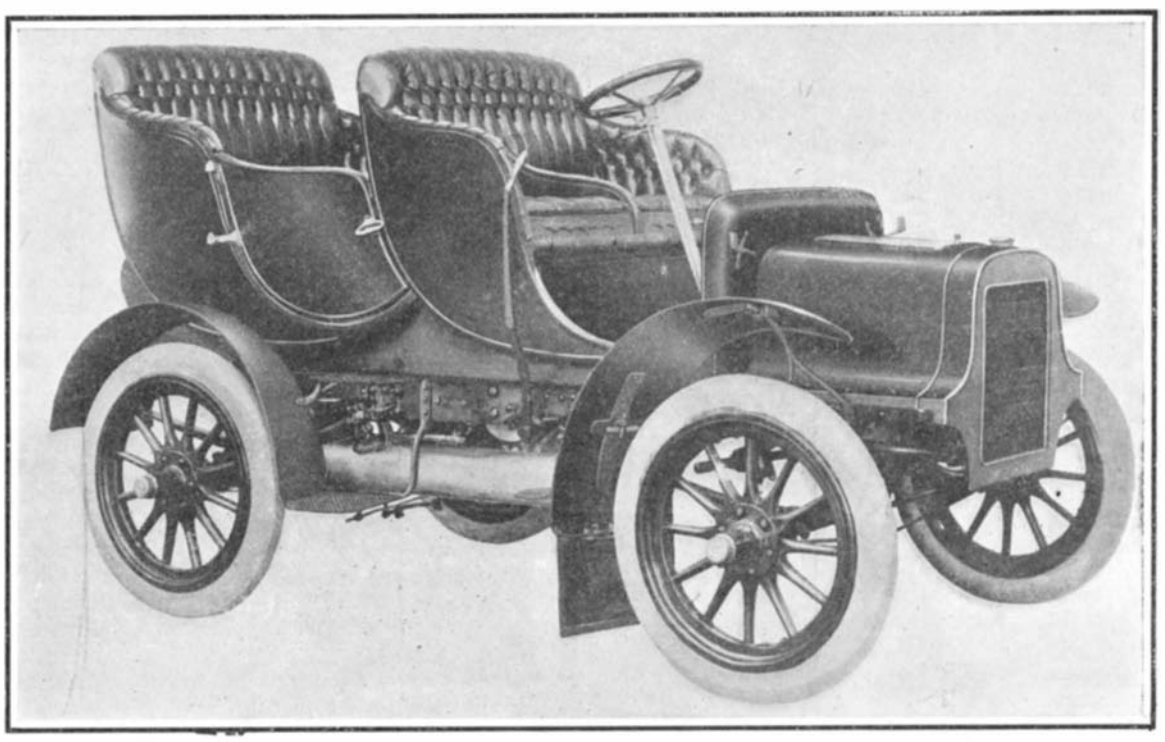
The motor is located underrear seat and can be readily inspected from behind the car. Parts: *A*, revolving crankcase; *B*, arm carrying insulated sector to which jump-spark wire is attached; *C*, gasoline tank and carbureter; *D*, inlet and exhaust passages to valves in head; *E*, auxiliary exhaust ports; *F*, porcelain binding post connected to spark-plug *G*; *K*, commutator; *P*, gasoline pipe from pump; *R*, oil tank; *SS'*, bulls' eyes showing gasoline level; *T*, ditto for oil.



MOTOR WITH ONE CYLINDER REMOVED, SHOWING ARRANGEMENT OF THREE CONNECTING-RODS ON ONE CRANK.

THE CADILLAC SINGLE-CYLINDER LIGHT TOURING CAR.

The graceful lines of the new single-cylinder Cadillac are apparent from our illustration. As far as the mechanism is concerned, this has undergone no radical change since the first car was built over three years ago. The workmanship is so good that many of the early cars are still in use to-day after receiving many hard knocks, yet being in constant service for several seasons. Simplicity and service are the things for which this car is noted chiefly. It is so constructed that any of the parts (including the crankshaft bearings) may be readily and cheaply renewed. Its single cylinder is fitted with a copper water jacket which is clamped in place without the use of gaskets. A thorough water circulation is maintained by a positively-driven centrifugal pump. The carbureter consists of a simple mixing valve operated by the suction of the motor. The spark plug is made up of two mica plugs set in a suitable cap. As both terminals of the plug are insulated, it does not short-circuit readily. The 1906 car is fitted with a mechanical oiler driven by a cam on the countershaft. This oiler forces oil through large pipes to the bearings, cylinder, and crank, the result being that the wearing parts are always properly lubricated. A very good feature of the car is that the starting crank can only be put on when the spark is retarded—an arrangement which makes a "kick back" of the engine impossible. The bore and stroke of the motor is 5 inches. Eight horse-power is guaranteed at the start, but after an engine has been run several months, a brake test will often show 10 horse-power or over at 1,300 R. P. M. The runabout will go 20 to 30 miles on a gallon of fuel, and the touring car 17 to 20. On English roads as high as 40 miles on a gallon has been attained. The front end of the machine is supported by a transverse spring mounted on a rocker which sets upon the upwardly-curving tubular front axle. Thus the axle can be raised at either end without affecting the body in the least. The car is fitted with double band brakes on the differential, which is driven from the engine by a hardened detachable roller chain of the cotter-pin type.



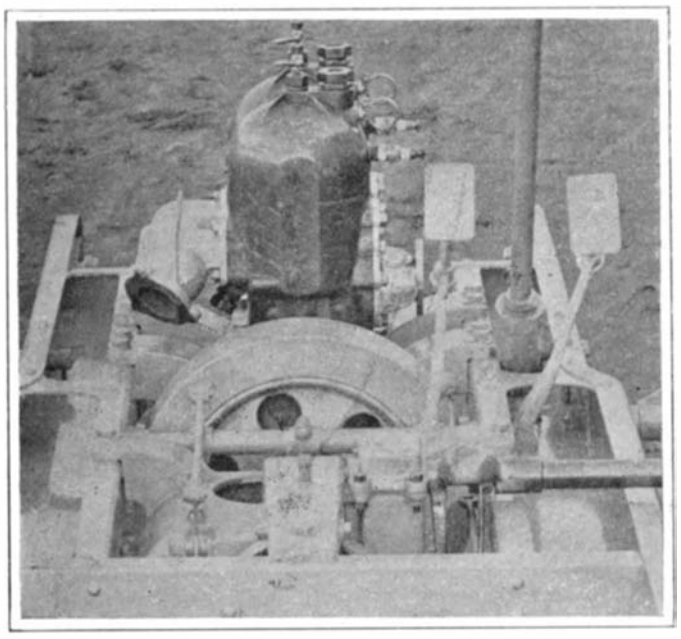
THE NEW CADILLAC 8-HORSE-POWER SINGLE-CYLINDER TOURING CAR.

The Cadillac company are also making two four-cylinder cars having 4⅜ x 5 and 5 x 5 engines respectively and being fitted with their three-speed planetary gear. These cars are very similar to that illustrated in our issue of December 16 last.

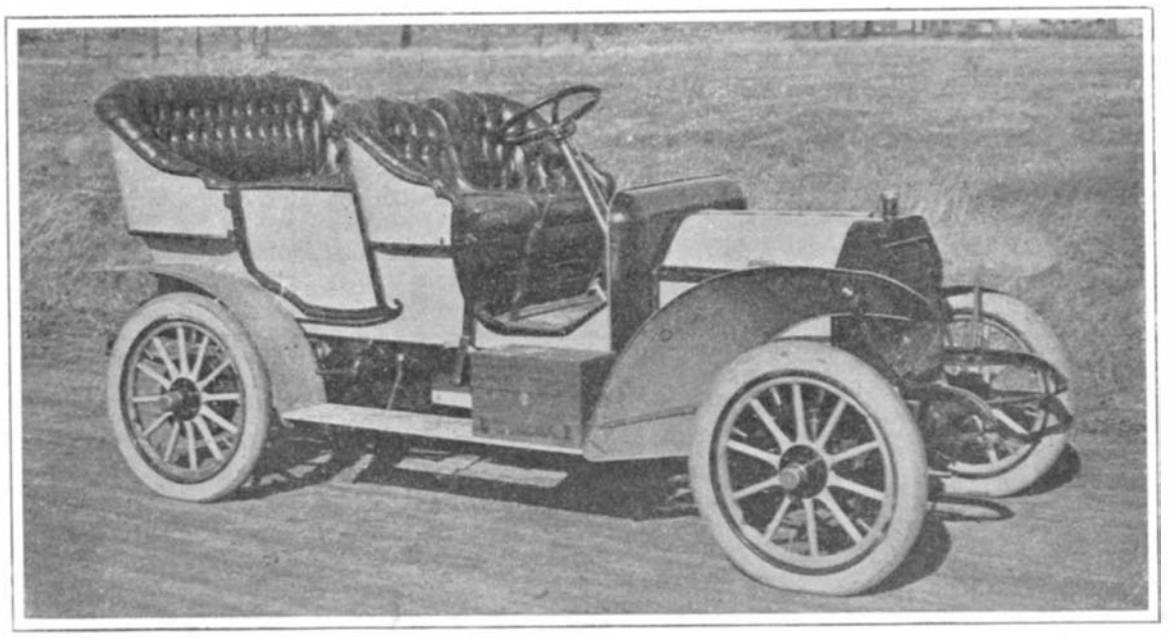
THE OLDSMOBILE TWO-CYCLE AND FOUR-CYCLE TOURING CARS.

The Olds Motor Works have this year brought out a new, light, side-entrance tonneau, shown herewith, which has for its motive power a two-cylinder, vertical, two-cycle engine, placed in front under the bonnet. The chassis of this car is identical with that of the larger four-cylinder four-cycle touring car. The front end of the two-cycle chassis is shown herewith. The motor is substantially constructed, having a large crankshaft and bearings 3 inches long. The latter have adjustable boxes for taking up the wear. A relatively high compression (about 8 pounds) is obtained in the crankcase, the space of which is filled by aluminium disks on the crankshaft. The transfer ports are of liberal dimensions, and as direct as it is possible to make them. The result is that about 25 horse-power is obtained with two 5 x 5-inch cylinders. This power is transmitted to the rear wheels through a three-speed sliding-gear transmission of the selective type and the usual universally-jointed propeller shaft and bevel gear drive at the rear axle. The latter is fitted with roller bearings, while the transmission has babbitt bearings, lubricated by oil-soaked waste. The transmission gears are of high-carbon steel, tempered and hardened. The lower half of the transmission case is removable, and the upper half is provided with an inspection cover for examining the gears. The view of the chassis from beneath shows very distinctly the arrangement of the different parts. A universal joint

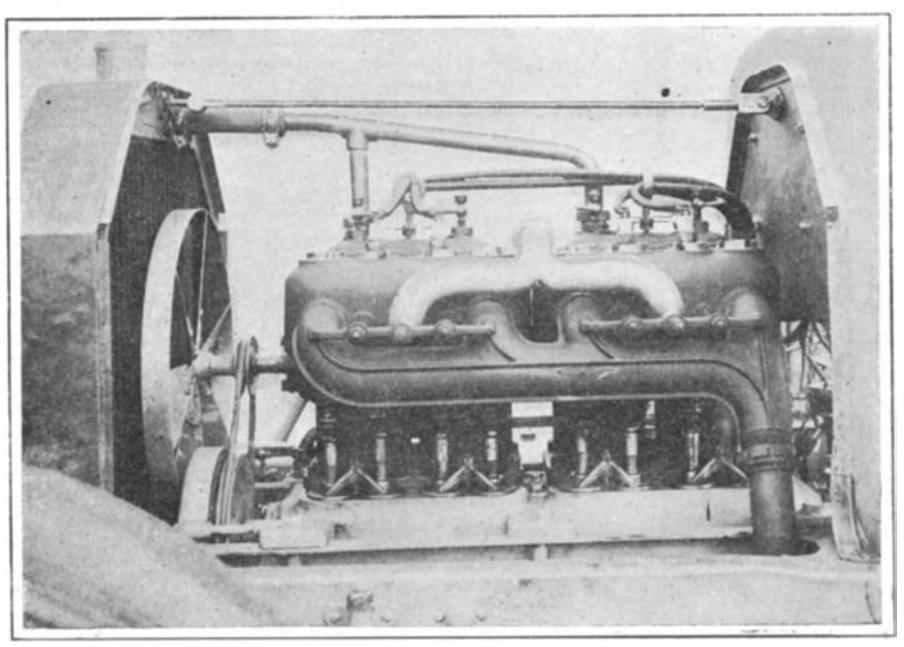
(*Continued on page* 50.)



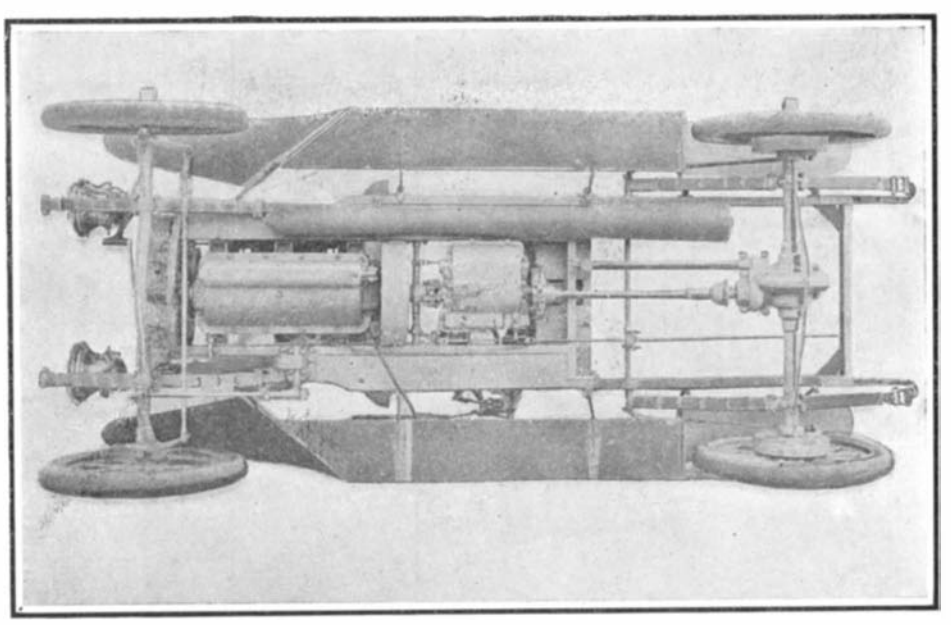
FRONT END OF CHASSIS OF OLDS 2-CYCLE CAR, WHICH HAS TWO 5 x 5-INCH CYLINDERS.



THE OLDS LIGHT, 2-CYLINDER, 2-CYCLE TOURING CAR. WEIGHT, 1700 POUNDS.



THE 4¼ x 4¾, 4-CYLINDER, 4-CYCLE OLDS TOURING-CAR MOTOR.



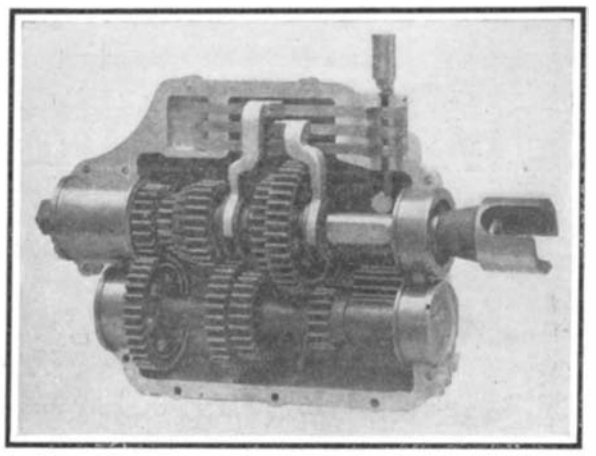
UNDER SIDE OF CHASSIS OF OLDS 4-CYLINDER CAR. A TYPICAL CHASSIS WITH BEVEL GEAR DRIVE.

A DETACHABLE LIMOUSINE TOURING CAR.

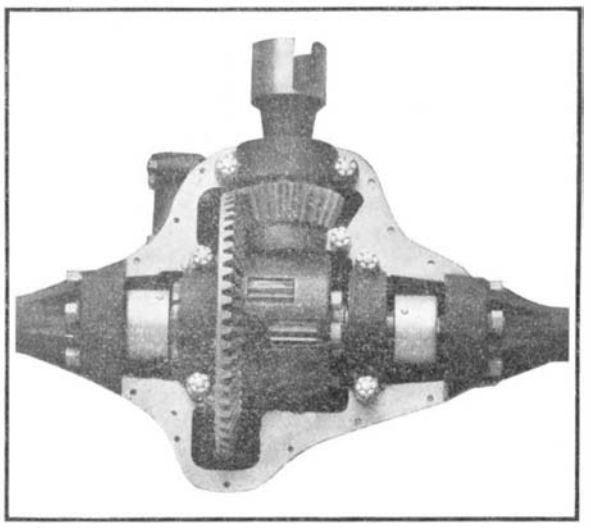
A strong, well-built touring car having a detachable Limousine top and several other novel features, is that made by the Welch Motor Car Company, of Pontiac, Mich. This machine has a standard 4⅝ x 5-inch four-cylinder motor, having a range of from 150 to 1,800 R. P. M., and rated at 30 to 36 horse-power. The top view of the motor, shown herewith, gives a good idea of the arrangement of the valves in the cylinder heads. The latter are made as near spherical as possible, so that the wall surface exposed to the flame is about one-third less than in the usual motor. This arrangement allows of the charge entering the cylinder quickly and in a cool condition. A full charge is drawn in and expelled from every cylinder during each two revolutions of the crankshaft. This form of cylinder and arrangement of valves is similar to that of the Fiat engine, which, it will be remembered, made such a remarkable performance in the Vanderbilt cup race last October. The burning of the charge is said to be quicker and more complete in a spherical combustion chamber, as the flame does not have to travel more than one-fourth as far as it otherwise would, in order to complete the ignition of the charge. Furthermore, the loss of power through the absorption of heat by the cooled cylinder walls is also largely cut down. On account of these facts, the makers claim 20 per cent more power than is obtainable with motors of the same size and of the usual construction. The perfect combustion of the charge and the straight exit it makes through the valve in the head eliminate all exhaust valve troubles, and make the motor particularly reliable.

The transmission used on this car has its gears always in mesh; but, by means of individual, multiple-disk clutches, no gears are running on the high speed. There are but two speeds forward and a reverse. Two multiple-disk clutches, of 150 square inches friction surface each, and a sliding jaw-clutch, are used to obtain these three speeds. All speeds are obtained with a single lever at the right of the driver, and the car can be thrown instantly from the high speed into the reverse.

A novel feature of this car is the arrangement of the pump (which is of the centrifugal type) in the center of the honeycomb radiator. The spindle of the pump projects through at the back of the radiator, and has the fan mounted upon it. A pulley on the hub of the fan is driven by a belt from a corresponding pulley on the crankshaft. The valves of the motor, which are set at an angle of 45 degrees, are operated by a central camshaft running over the cylinders and driven by bevel gears from the crankshaft. The timer is also located on a vertical bevel-gear-driven shaft, at the forward end of the motor. High compression is used in this engine, and is said to make it very efficient.



The Peerless 4-Speed, Selective-Type Transmission.



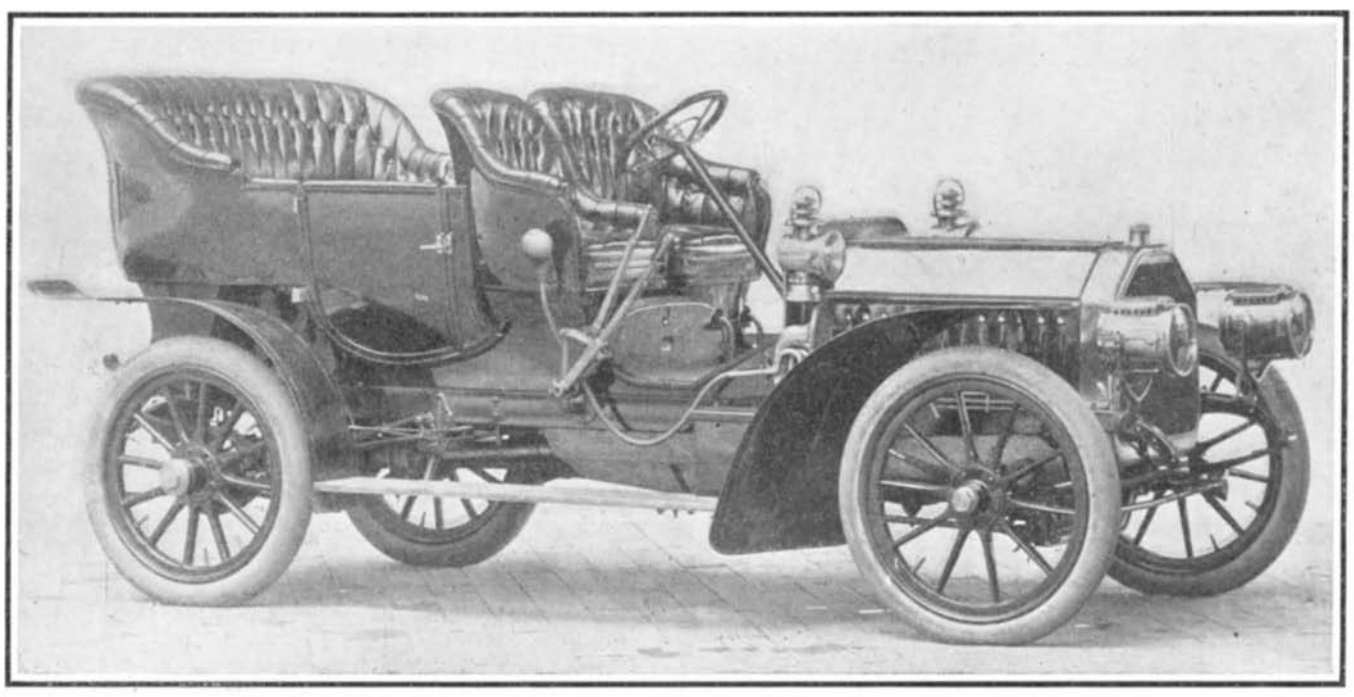
The Peerless Bevel Gear Drive, Showing Spur Gear Differential with Ball Bearings and Universal Joints on Each Side.

The radiator contains 13,500 square inches of radiating surface. It is made up of seamless brass tubing, and, although all the tubes form a solid mass, any one tube can be easily removed and replaced, if necessary. If the pump should cease to work, the radiator would still operate on the thermo-siphon principle. This car is noted for the use of plain bearings almost throughout. These are very generous in size, and are made invariably of steel on bronze, each bearing being automatically flooded with oil. A telescopic steering post is one of the novel features of this machine, and is an arrangement which adds greatly to the comfort of the driver in getting in and out of the car. The Welch machine is one of the largest and most handsomely finished American touring cars. Besides the novel features in its construction, the fact that the closed Limousine top may be removed wholly or in part makes it a particularly useful car for all-year service.

THE PEERLESS 30-HORSE-POWER TOURING CAR.

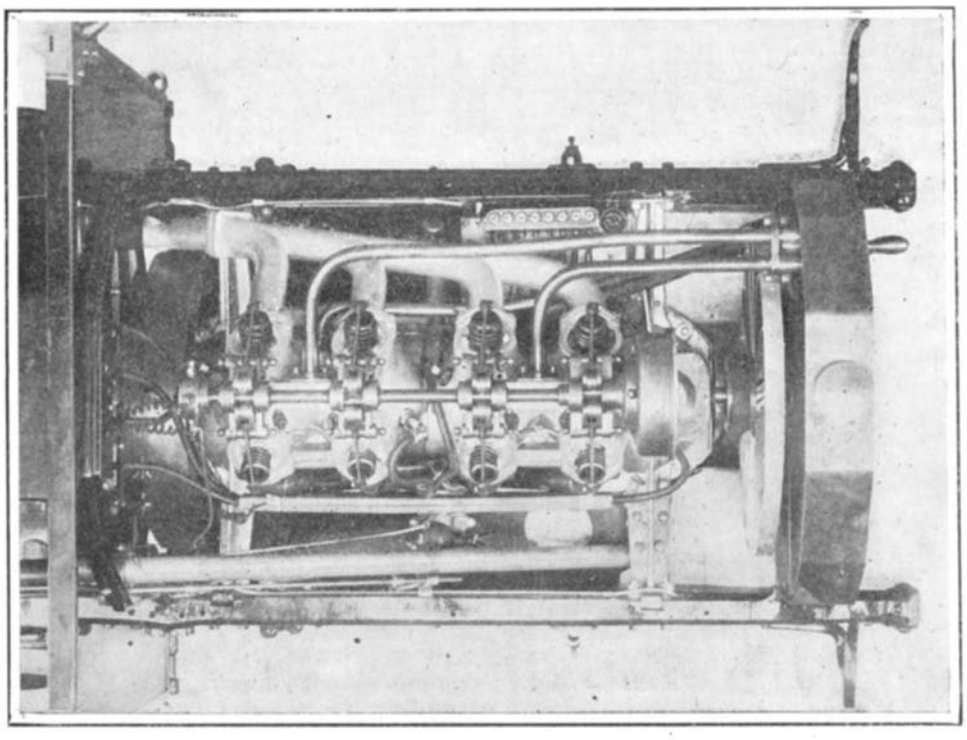
The new touring car put out by the Peerless Company, while having no very radical changes over last year's machine, has been improved in various places and brought thoroughly up to date. The cylinders of the motor are cast in pairs, with inlet and exhaust valves on either side and mechanically operated by separate camshafts. All the valves and valve springs are interchangeable. The cylinder castings are imported from France, and great care is taken in the boring and finishing of the cylinders. The bore and stroke of these cylinders are 4½ by 5 inches, and the motor develops its full power at 1,000 R. P. M. All gears, as well as the water pump and governor, are completely incased. The motor is lubricated by the splash system, the oil being fed by a mechanical lubricator. An automatic float-feet carbureter having a water jacket supplies the gas to the engine. Ignition is by storage batteries and individual coils. The commutator is located just back of the rear cylinder, it being set at an angle of 60 degrees and driven by bevel gears from the camshaft. The commutator consists of a roller

(*Continued on page 50.*)



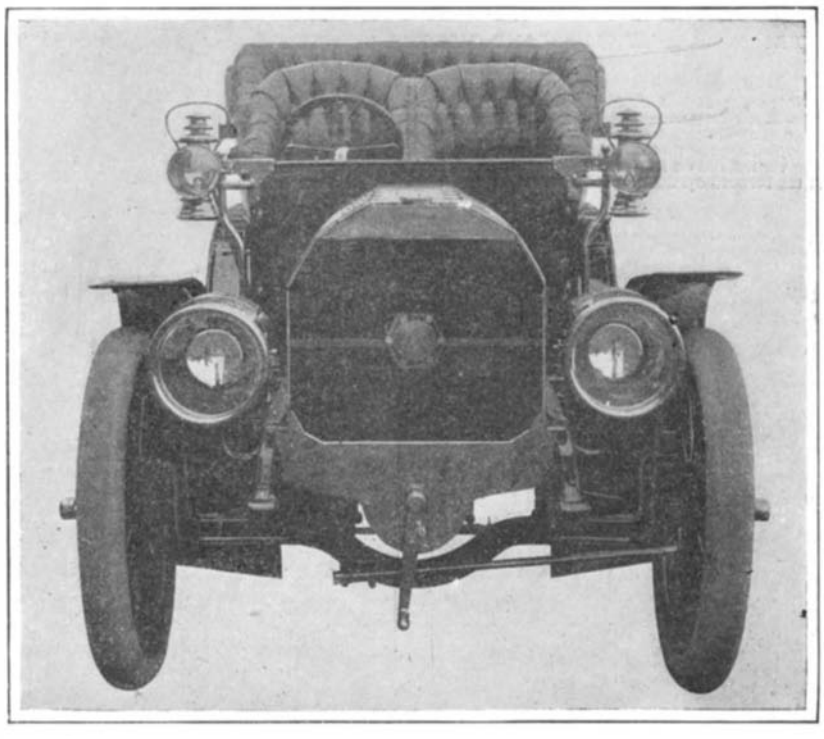
THE 1906 PEERLESS 30-35-HORSE-POWER TOURING CAR HAVING SHAFT DRIVE AND 4-SPEED TRANSMISSION.

Note the complete protection of engine and transmission by means of a steel pan.



TOP VIEW OF THE WELCH 4⅝ x 5, 4-CYLINDER MOTOR.

The valves set at an angle of 45 deg. in the cylinder heads and operated mechanically by rocker arms moved by a central longitudinal cam shaft, are the main features of this engine. The commutator is on the left-hand end of camshaft, the other end of which is driven by an incased bevel gear. The spark plugs are seen in the cylinder heads, the 8-feed mechanical oiler beside the upper frame, and the individual exhaust pipes and twin water pipes, as well as the belt-driven fan, are also distinctly visible. The long rod at the bottom of cut is the patent telescopic steering column.



THE 30-36-HORSE-POWER WELCH 4-CYLINDER TOURING CAR TO WHICH A LUXURIOUS LIMOUSINE TOP CAN BE ATTACHED.

Note the heavy I-beam front axle and the centrifugal water-circulating pump in the center of the radiator. The latter is a novel and distinctive feature of the Welch car.

HIGH-POWERED AMERICAN TOURING CARS.

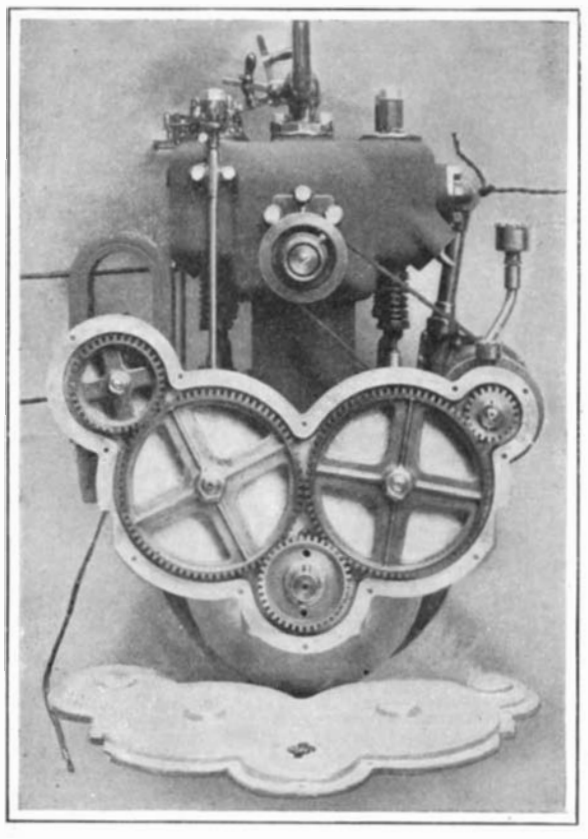
CLEVELAND 30-HORSE-POWER TOURING CAR.

A substantially-built touring car of modern construction is the 30 to 35-horse-power Cleveland shown in the annexed illustrations. This car is thoroughly up to date and, besides the usual three-speed transmission and bevel-gear drive, it has several improvements that are usually found on the best foreign cars. The first of these is the adoption of the low-tension make-and-break system of ignition with a gear-driven Sims-Bosch magneto as the source of current. The operation of the igniters is shown in the smaller cut. By referring to this cut, the reader can see that the chief parts of each igniter mechanism consist of a small cam-shaped projection, *T* (which is part of the movable stem of the igniter) and a long finger, *D*, which is mounted upon an eccentric and is clamped to a vertical rod driven by bevel gears from the camshaft. Another eccentric, *E*, is placed beside the finger, *D*, and the latter is held against *E* by a light spring, *F*. Another light spring, *S*, separates the electrodes after they are pressed together by the finger, *D*, and then suddenly released. A reciprocating motion is given *D* by the eccentric upon which it is mounted, and as it approaches the finger, *T*, it is pushed sideways by the eccentric, *E*, so that after it has moved *T* a certain distance and made the contact within the cylinder, it slips off *T* and allows the latter to spring back, under the influence of the spring, *S*. The result is the circuit is made and quickly broken, which gives a large spark. The insulated post of the igniter is shown just at the left of *F*. This is connected to a common bus-bar by means of switches, seen above the motor in the other view. The system of levers, *H*, *H*, *H'*, are connected so as to rock the different eccentrics, *E*, and cause them to throw the rods, *B*, out of contact with the fingers, *T*, earlier or later. The spark is retarded in this way when starting, and afterward it is set about at dead center. As the magneto speeds up, the spark increases in volume and ignites the gas quicker, which has the same effect as an automatic advance.

THE 30-35-HORSE-POWER CLEVELAND 4-CYLINDER TOURING CAR.

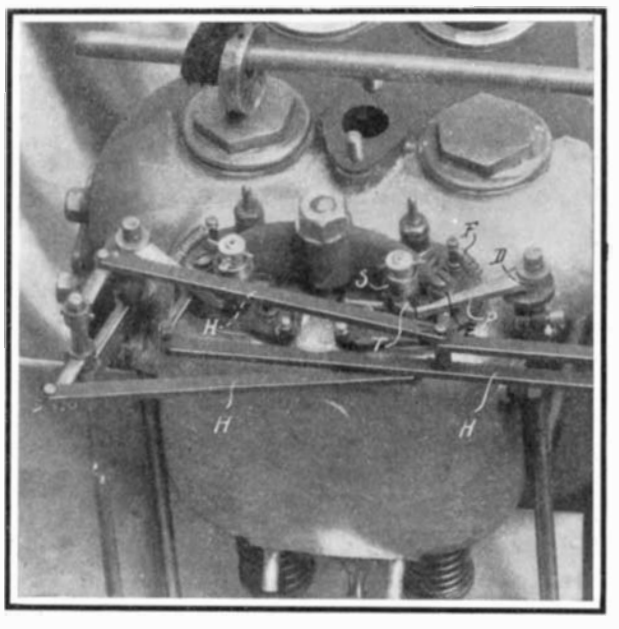
The end view of the motor shows the two half-speed gears in mesh with the smaller gear on the crankshaft. These drive still smaller gears, which rotate the water pump and fan (through a belt) and the magneto, respectively. The illustration shown above on the left is a typical end view of a modern motor having valves placed symmetrically on each side. The present practice is to inclose all the gears and run them in an oil bath, which gives them a long life and does not produce much noise. The motor is built strongly and of the best material. It is lubricated by a force-feed oiler, which supplies oil to all of the bearings. The crank-pin bearings are fitted with patent ring oilers, with which the oil is thrown by centrifugal force into the hollow crank-pin. The cylinders are 4⅛-inch bore by 5¼-inch stroke. The transmission gives three speeds forward and a reverse, with a direct drive on the high speed. It is connected with the rear axle through the usual propeller shaft having two universal joints, the rearmost of which is provided with a slip joint, to compensate for the vertical movement of the car upon its springs. The rear axle is of the usual tubular type, with which the wheels are carried upon ball bearings. The differential gear within this axle, and the live axles which drive the wheels, all run on ball bearings. Internal expanding brakes are placed in the rear wheels. The muffler of this car is much like that of the Richard-Brazier. It is composed of concentric tubes having perforations of sufficient area to allow the gas to expand from one chamber to the other without back pressure. Flattened tubes projecting back of each rear wheel emit the exhaust gases, which lay the dust rather effectually. The machine is fitted with 34 x 4-inch tires,

(*Continued on page 51.*)

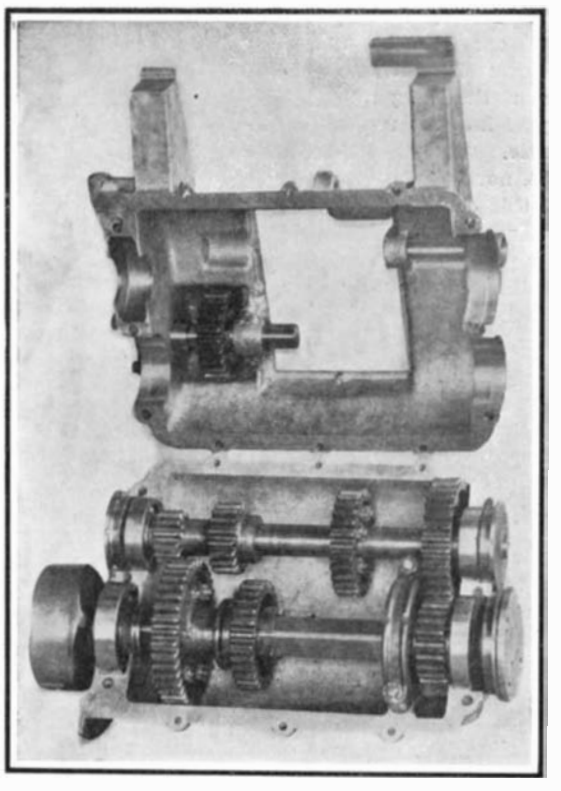


FRONT VIEW OF CLEVELAND MOTOR WITH GEARS EXPOSED.

Note make and break igniters with knife switches above on left and gear-driven magneto below; also centrifugal water pump and pulley for fan on gear-driven shaft on right. The large gears are on the cam shafts for operating the valves. These shafts run at half the speed of the motor. The vertical rod on left-hand side of motor operates the igniter mechanism of the forward cylinder and is revolved by a bevel gear on the camshaft.

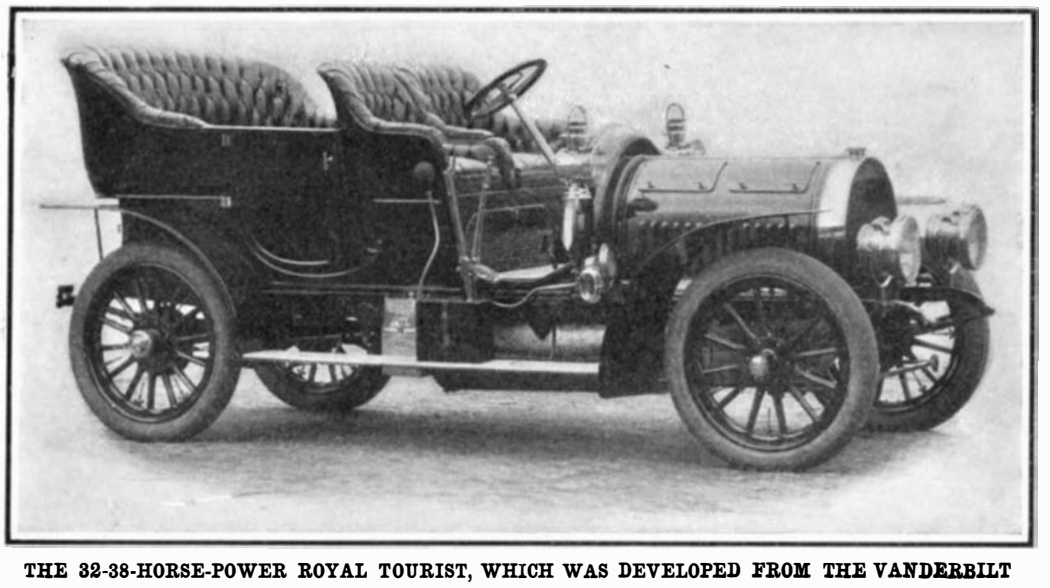


IGNITER MECHANISM OF ONE PAIR OF CYLINDERS OF CLEVELAND TOURING CAR.

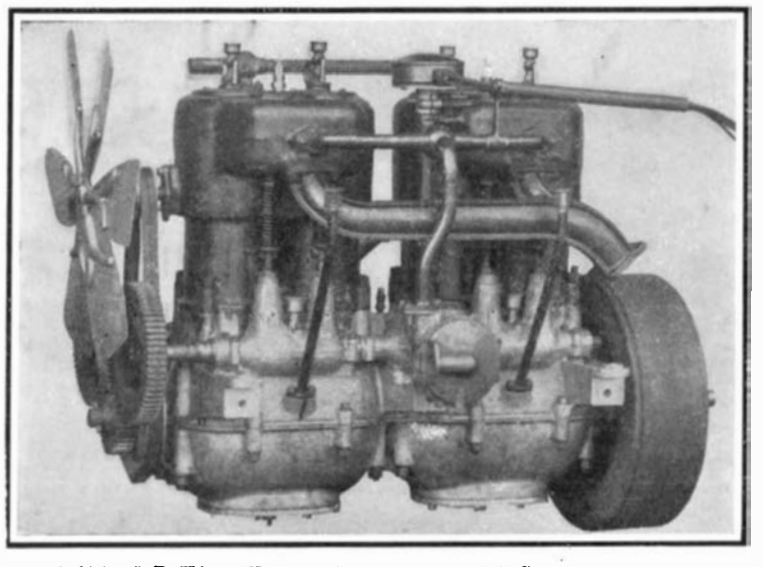


GEAR BOX OF THE ROYAL TOURING CAR

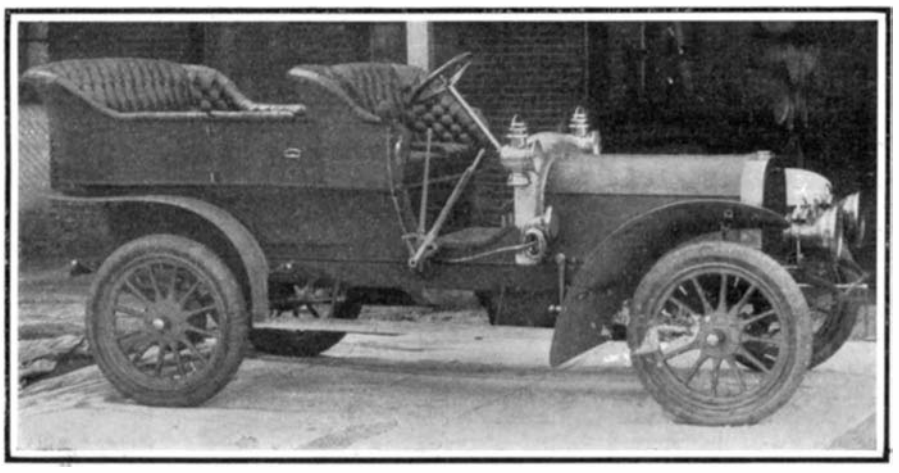
This is a typical 3-speed sliding-gear transmission. The hangers are on the top of gear box, which also carries intermediate pinion for the reverse. The single sliding member on square lower shaft is moved by a fork fitting in collar between the two gears and mounted on a slidable rod carried in top of case. The jaw teeth on right side of sliding member engage similar teeth in extreme right-hand gear for producing the third speed, which gives a direct through drive from one end to the other of lower shaft.



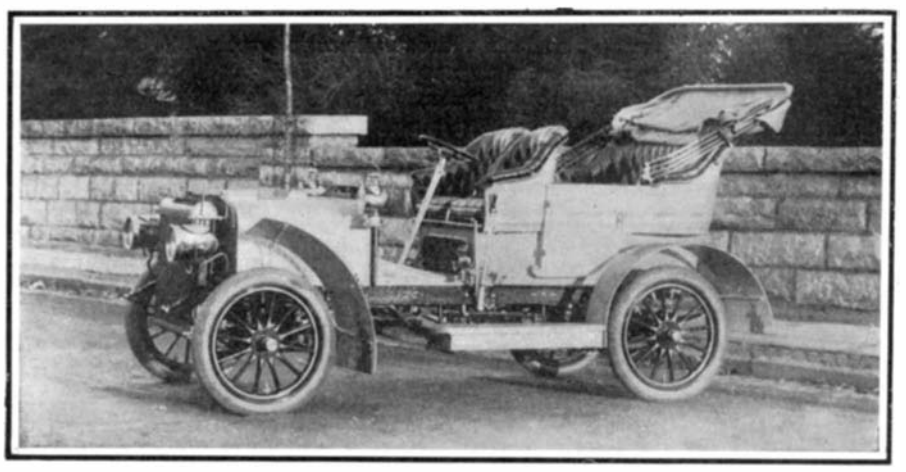
THE 32-38-HORSE-POWER ROYAL TOURIST, WHICH WAS DEVELOPED FROM THE VANDERBILT CUP RACER.



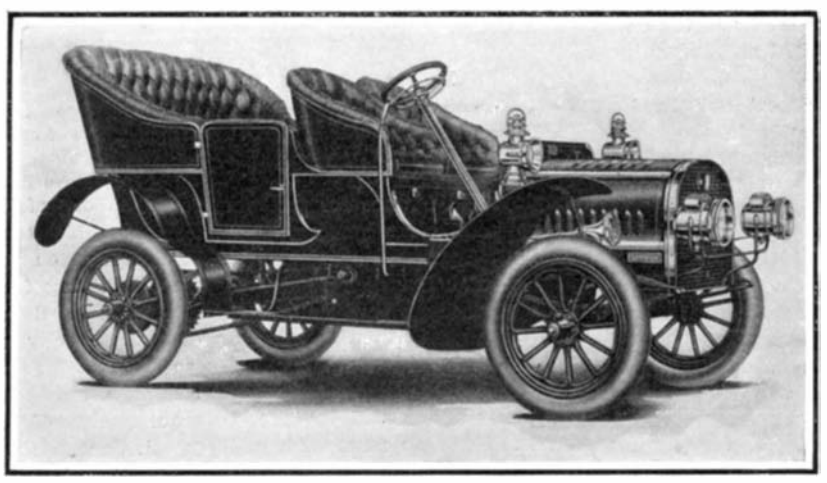
THE 4½ x 5 ROYAL ENGINE, SHOWING BEVEL-GEAR-DRIVEN PUMP AND COMMUTATOR.



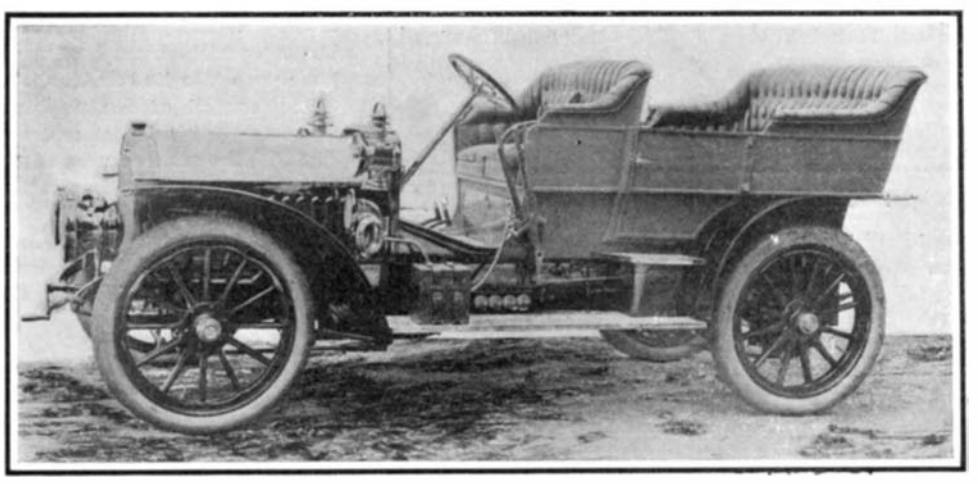
The Haynes 50-Horse-Power Touring Car.



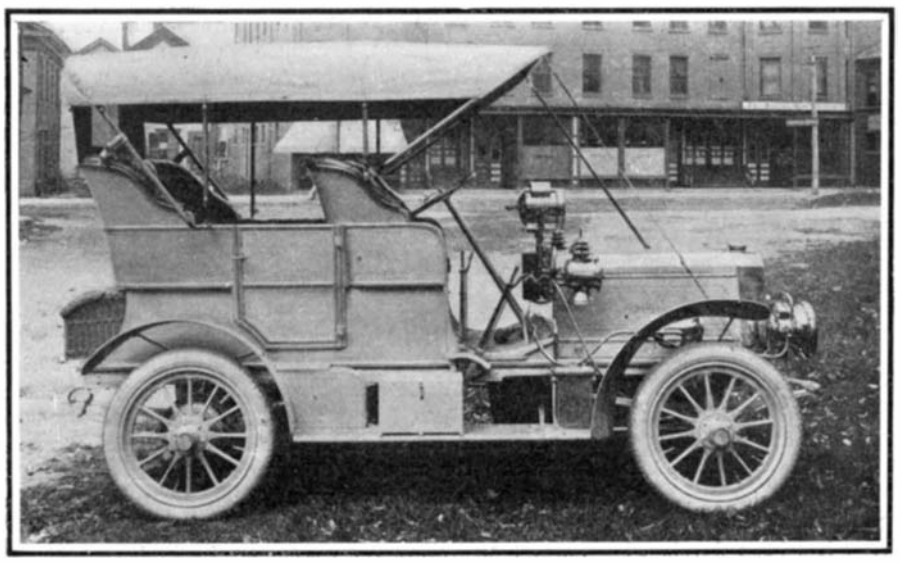
The 1906 Lane Steam Touring Car. This is One of the Few Steam-Propelled Cars Still Manufactured.



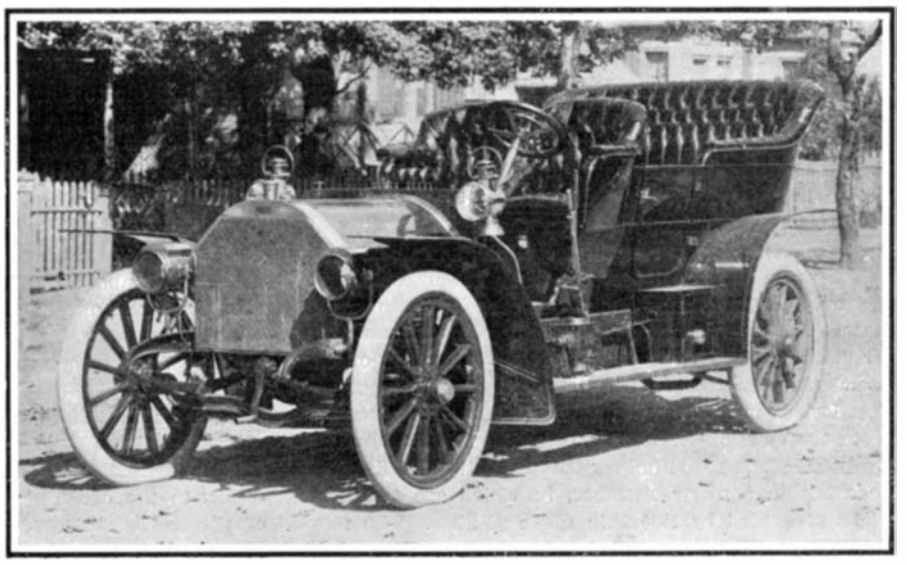
The Rambler 18-Horse-Power Double-Opposed-Cylinder Touring Car.



The 40-45-Horse-Power Columbia Heavy Touring Car.

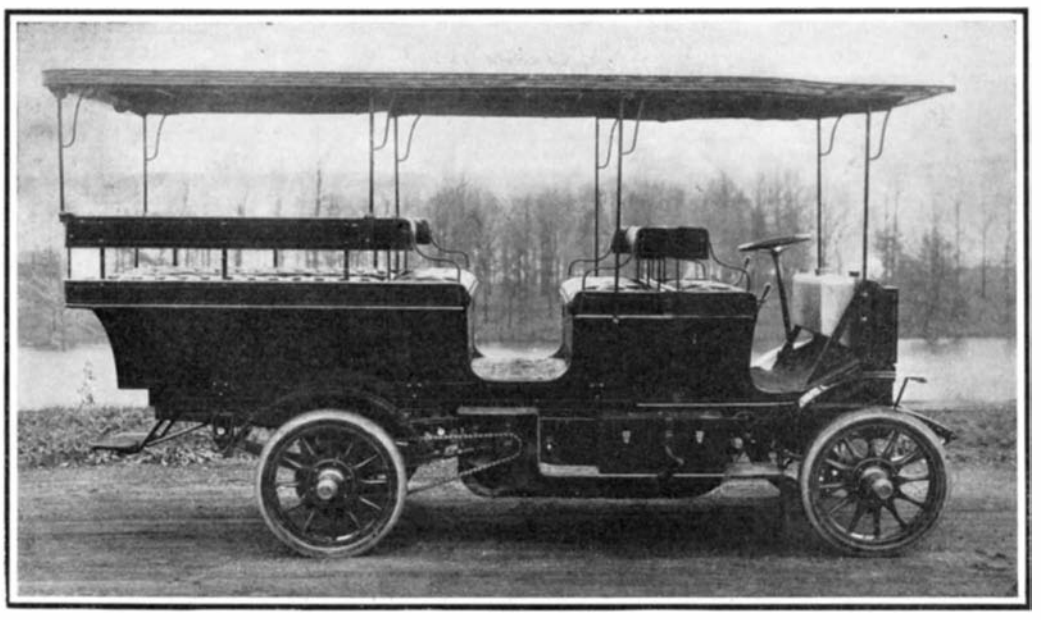


The New Grout 30-35-Horse-Power, 4-Cylinder, Gasoline Touring Car.



The 45-60-Horse-Power New American Mercedes. An Exact Duplicate of the Famous German Machine.

The 16-Horse-Power 1½-Ton Truck of the Rapid Motor Vehicle Company.



The 20-Passenger Oldsmobile Bus Fitted With a 16-Horse-Power, 2-Cylinder, Vertical Motor.

SOME OF THE LARGEST HIGH-POWERED AMERICAN TOURING CARS AND COMMERCIAL VEHICLES.

A NOVEL 4-CYLINDER TOURING CAR.

The new Northern touring car is of the 4-cylinder type. The cylinders and water jackets are all in one galvanized casting, the cylinders being properly spaced to allow of a thorough circulation of water. The bore and stroke of the motor are 4½ x 5. It is rated at 30 horse-power, and, at 900 R. P. M., will drive the car

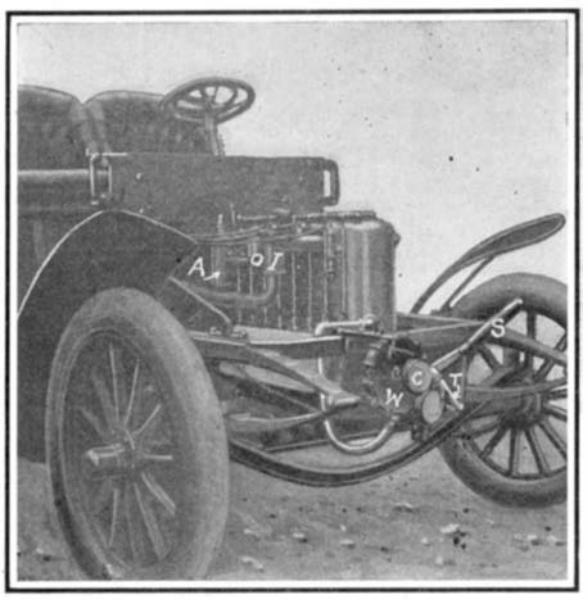


Fig. 1.—FRONT END OF NORTHERN TOURING CAR.

The radiator is removed so as to show parts. *A.* Air compressor. *C.* Contact box. *I.* Inlet pipe. *O.* Carbureter. *S.* Starting lever. *T.* Water pipe. *W.* Inclosed half-speed gears forming water pump.

at a speed rate of 30 miles an hour. The crankshaft is offset slightly from the center line of the cylinders in order to get a better leverage on the power stroke, and the same practice is followed with the cam shaft, which is placed at one side of the valve stems instead of directly under them. The engine has liberal hand holes in the base for adjusting the crankshaft bearings. The valves are all in the heads, and are operated mechanically by tappets and push rods. The eight rods can be seen on the left side of motor in the cut. The carbureter, a small float-feed affair, is fastened to the inlet pipe, *I*, at *O*. No special water pump is used, the inclosed 2-to-1 gears at the front end of the motor being made to serve this purpose. The water pipe is shown running from the base of the forward cylinder to the incased gears. The pipe, *W*, on the other side conveys the water to the radiator, and thence to the water jacket. The radiator, which is not shown in this view, is placed as usual in front. The commutator is located at *C* on the same shaft with the 2-to-1 gear. It is readily accessible, as can be seen. While these are novel features, they are by no means the only original ones about the car, for the control, clutch, and transmission are all along novel lines. An air compressor (*A*, Fig. 1) is driven by a crank on the camshaft. A valve on top makes it possible to obtain any desired pressure up to a certain point. A pipe runs from the compressor to the forward end of the crankshaft, which is made hollow throughout. The flywheel contains an annular chamber, in which are two steel disks separated by two thin disks of fiber. The rearmost steel disk is connected to the propeller shaft through a universal joint. Both disks, as well as the joint, are thoroughly inclosed and protected. The chamber in the flywheel is air-tight, and by admitting the air pressure between the disks it locks them to the

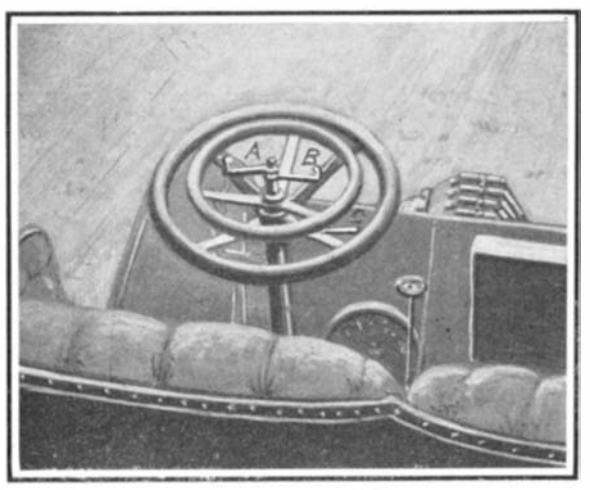


Fig. 2.—CONTROL APPARATUS OF NORTHERN CAR.

The gears are shifted by the smaller wheel within the steering wheel. *A.* Spark handle. *B.* Clutch handle. *C.* Throttle and air brake handle.

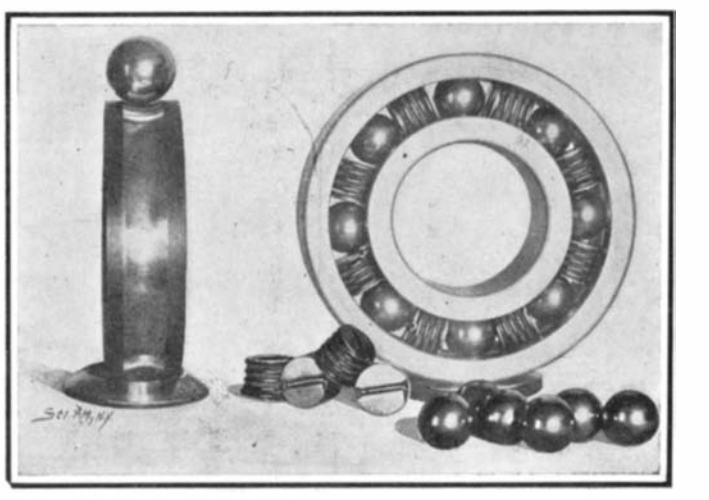
flywheel, which then drives the propeller shaft. The disks are 11 inches in diameter, and with 75 pounds air pressure, three tons driving pressure is obtained in the clutch. By opening the air valve a little at a time, the clutch may be made to take hold very easily and without any jerks. The transmission is located just in front of the rear axle, and the only connection, in addition to the propeller shaft, which it has with the front of the vehicle is a single rod for shifting the gears. This rod is connected so as to be operated by a smaller wheel within the steering wheel. The reverse is obtained by depressing a pedal on the steering column. It is impossible to throw the reverse into action unless the gears are in neutral position. The great strength of the rear axle and the wide band-brakes employed on the hub of the rear wheels can both be seen in Fig. 3, which also shows the long muffler tubes extending nearly the whole length of the body underneath the same. The band brakes are operated by compressed air, and are very powerful. The bands are 3½ inches wide. Inside the brake drums are expanding ring brakes 3 inches wide. These are operated by a pedal, and are to be used in case of emergency.

Still another novel feature of the new Northern touring car is the lever starting apparatus shown in Fig. 1. This consists of a long lever having a pawl engaging with a ratchet-toothed wheel on the motor shaft, and thus making it possible to turn the motor over easily by a series of pulls straight from the shoulder, instead of having to swing a large crank. Grease cups on the bolts of the springs keep these properly lubricated at all times. This is one of the minor details of the car, but one which shows how much thought and ingenuity have gone into its construction.

The control of the machine is almost entirely by the three small levers and the two wheels shown in Fig. 2. The smaller wheel, as previously stated, shifts the gears and gives the first, second, and third speeds forward. A direct drive is obtained on the high speed. By turning this wheel back to the neutral position, and depressing the pedal at the base of the steering column, the reverse is obtained. The small lever, *B*, operates the clutch, while the lever, *A*, is for advancing or retarding the spark. Below the steering wheel is the throttle lever, *C*. Moving this forward opens the throttle, while moving it backward closes the throttle and applies the air brakes. Thus it can be seen that the car is controlled almost entirely by the back-and-forth movement of this one lever. The location of the steering column on the left side of the car is an advantage in passing through traffic, as it enables the driver to see what is in front of him before turning out for a vehicle. Furthermore, when approaching a curb, the empty seat is always next to the latter, and it is not necessary for the car to be turned around. The weight of this car is approximately 2,300 pounds, and the speed possible to obtain with it is in the neighborhood of 50 miles an hour. The car has a wheel base and a body capable of accommodating five people. It is shod with 32 x 4-inch tires. Besides this new car, which is constructed under the patents of Charles B. King, the Northern Manufacturing Company still builds its double-opposed-cylinder touring car and its single-cylinder runabout. A feature of the former car is the use of interchangeable bodies, which makes possible a closed Limousine for winter, or an open side-entrance tonneau for summer use.

A SILENT NON-ADJUSTABLE BALL BEARING.

Ball bearings were originally used on some of the first automobiles constructed in this country; but owing to the constant trouble which they gave, most of the makers discarded them. During the last two years a new type of ball bearing has been developed in Germany, and has found its way into use on many of the leading foreign cars. Owing to the fine quality of steel used in its manufacture, and to the great care with which the balls are examined and tested, this bearing has shown itself to be very reliable under almost all conditions. Its friction is so small that the loss amounts to only 1-8 or 1-6 of one per cent of the total load carried, instead of from 3 to 5 per cent; while the starting friction is no greater than the friction when running. The new bearing consists of two annular ball races, each of which is in one piece. By placing the outer ring in a position eccentric to the inner one, the balls can be slipped into place with the coiled springs between them. The latter keep the balls separated, so that there is no clicking sound as they drop over the top of the bearings, such as is the case with the ordinary bearing. A wool pad placed inside the spring absorbs sufficient oil to keep the balls lubricated for long periods. The balls and races are made from a special high-grade steel. Both are very hard and tough, and have a high polish. Numerous tests are constantly made of sample sets of bearings, in order to be certain that the quality is maintained and in order to improve, if possible, this quality. As the result of such tests the manufacturers have discovered a new steel alloy that allows the load on the bearings to be doubled. But one ring of balls is used in any bearing, the result being that the space required is much smaller than is usual. The fewer balls used also tend toward simplification. These bearings are used almost universally in the transmissions and wheels of high-grade cars. The Daimler Company has become a convert to their use on the engine crankshaft, and both the Mercedes and Hotchkiss machines use them in this important part. Their high efficiency and the little attention which they require make them ideal for automobile service.



THE HESS-BRIGHT NON-ADJUSTABLE SILENT BALL BEARING USED ON MANY HIGH-GRADE TOURING CARS.

The Current Supplement.

Jacques Boyer opens the current Supplement, No. 1567, with a most thorough article on the methods

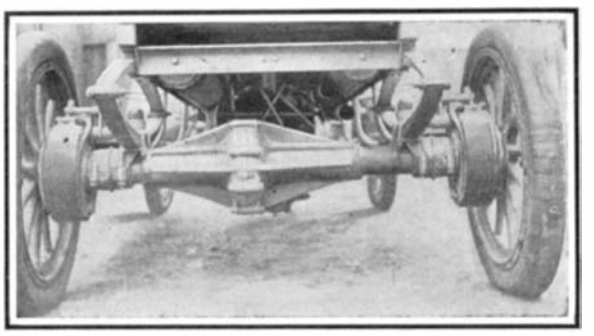


Fig. 3.—NORTHERN REAR AXLE.

The wide band brakes are applied by compressed air. Expanding emergency brakes are connected with a pedal. The long muffler tubes can be seen on each side beneath the body.

employed in France for fattening fowls. Wonderfully sharp and clear photographs accompany his text. John C. Sparks gives some wholesome advice on the subject of boiler compounds. Of the interesting features of modern constructive practice which call for appraisement, either from their extreme novelty or successful application, none holds so high a place as the remarkable adaptability of armored concrete to the many and varied engineering requirements of the times. For this reason Lieut. Henry J. Jones's thorough discussion of the subject will doubtless be read with interest. Sir Oliver Lodge, in a most striking paper entitled "A Pertinacious Current; or, the Storage of High-Tension Electricity by Means of Valves," shows how it is possible to dissipate fog or smoke or to deposit metallic fumes. A tunnel was recently bored through the Santa Cruz Mountains which is of engineering interest, inasmuch as it is approached at one end through a concrete retaining wall or dam that has stood for over eleven years without the least sign of cracks or any failure whatever. Mr. Herbert I. Bennett describes this wall and its method of construction. Prof. A. E. Outerbridge reviews recent progress in metallurgy. The Generation of Ozone by Means of Ultra-violet Light is briefly described.

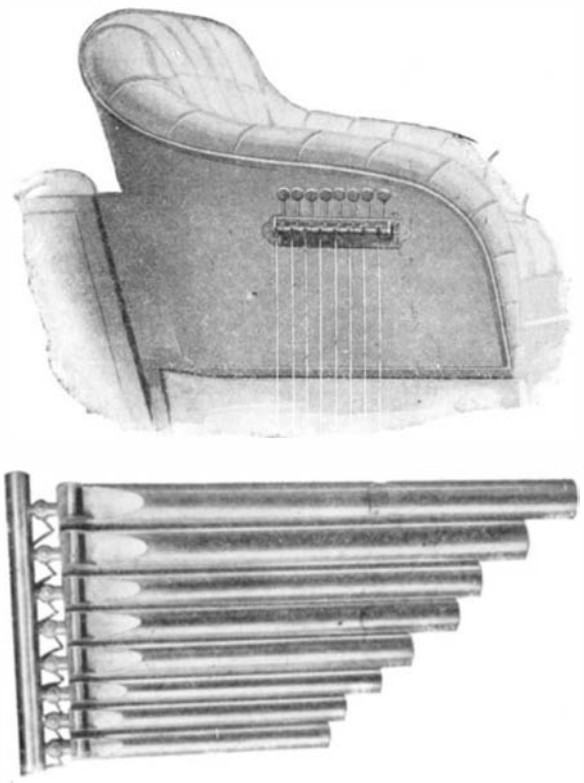
Official Meteorological Summary, New York, N. Y., December, 1905.

Atmospheric pressure: Mean, 30.09; highest, 30.86; lowest, 29.46. Temperature: Highest, 57; date, 3d; lowest, 19; date, 1st; mean of warmest day, 48; date, 3d and 29th; coldest day, 24; date, 15th; mean of maximum for the month, 43.6; mean of minimum, 31.8; absolute mean, 37.7; normal, 34; average daily excess compared with mean of 35 years, + 3.7. Warmest mean temperature for December, 42, in 1891. Coldest mean, 25, in 1876. Absolute maximum and minimum for this month for 35 years, 68, and — 6. Average daily excess since January 1, + 0.2. Precipitation: 3.67; greatest in 24 hours, 1.38; date, 20th and 21st; average for this month for 35 years, 3.40; excess, + 0.27; accumulated deficiency since January 1, — 0.17. Greatest precipitation, 6.66, in 1884; least, 0.95, in 1877. Snow, 0.7. Wind: Prevailing direction, west; total movement, 10.774 miles; average hourly velocity, 14.5 miles; maximum velocity, 64 miles per hour. Weather: Clear days, 8; partly cloudy, 12; cloudy, 11.

Automobile Novelties and Improvements.

THE GABRIEL HORN.

During the past year many large cars have been fitted with a compound horn, or whistle, giving a musical



EXHAUST-BLOWN HORN SOUNDING AN OCTAVE.

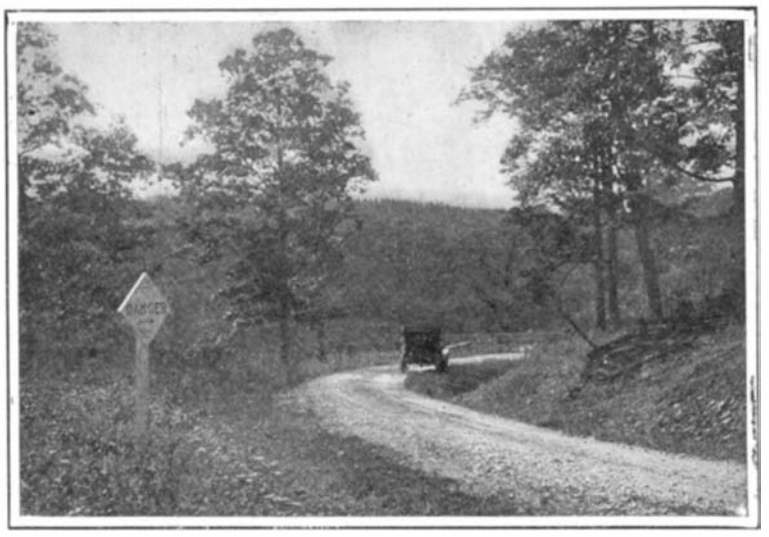
note of varying pitch and intensity. This horn is worked directly from the exhaust pipe of the motor, and it can be applied to any multiple-cylinder car. An improved horn of this type, having eight separate pipes, has recently been put on the market. The new horn is a sort of miniature pipe organ, being operated by a keyboard and being capable of sounding a full octave. The improved horn can be made to play a tune when a musically-inclined person fingers the keyboard.

DANGER SIGNS FOR AUTOMOBILISTS.

More than three hundred accidents to motor-car tourists have been reported in the United States and Canada during 1905, many of them resulting fatally. It cannot be said that these accidents were wholly due to rapid speed or reckless driving, for some of the most serious ones happened to automobilists who are known to be prudent and careful in the management of their vehicles. Most of them could have been avoided by a better knowledge of the danger points, or by some warning by which the tourist could have been advised of the proximate peril. The truth is that in many parts of the country, and especially in those sections which are most picturesque and attractive to the tourist, the highways are too narrow and winding and are often skirted by deep unguarded ditches and dangerous gullies, and crossed by railroad tracks at points where the tourist would have little reason to anticipate them.

To lessen these perils as much as possible, the American Motor League has called upon its consuls, members, and proprietors of official stations, in all the important States where touring is most popular, to take up the work of erecting danger signs and guide boards, by which the tourist may be forewarned and his course directed to the avoidance of these pitfalls. Many of these danger signs have already been put up, and the Pittsburg Board of Consuls of the American Motor League has been particularly active in western Pennsylvania in putting this work in evidence. The league sends out stencils, from which these signs can be easily made by a man of ordinary skill, and in some cases the completed signs are sent out ready to be put up.

Blanks are being sent to automobilists in several States, with letters requesting information as to points where these signs should be erected, and a contract has been made with a firm in central New York for a large number of signs, which will be put up in place within the next few months. It is believed that before the end of 1906 more than three thousand of these signs will be placed in different parts of the United States.



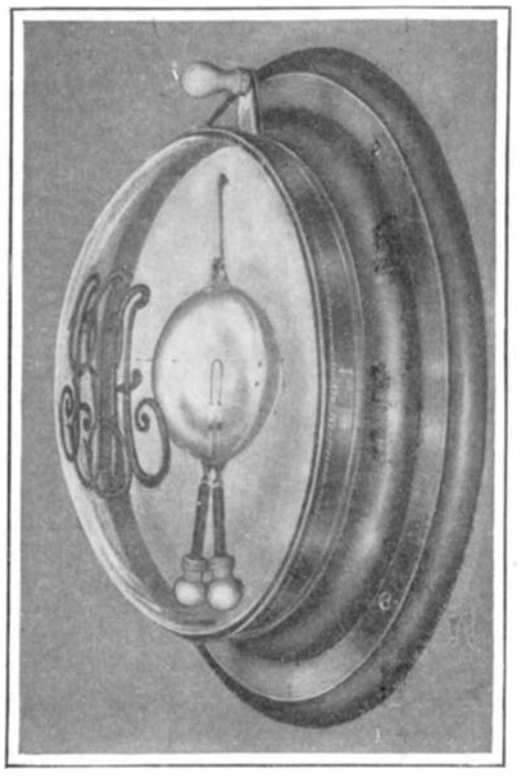
ONE OF THE AUTOMOBILISTS' ROAD SIGNS THAT ARE BEING LOCATED IN DANGEROUS PLACES.

ELECTRIC LIGHT FOR CLOSED CARRIAGES.

The little lamp shown herewith is intended to be used in the roof of a Limousine or other closed body, and to be run from the ignition accumulators with which all large cars are supplied. The lamp is fitted with a silver-plated reflector mounted in a supporting ring. In front of the reflector an incandescent lamp of special design is hung on silver springs mounted in ivory bushings. An oval, beveled, plate-glass cover locks on the rim, and effectually protects both lamp and reflector. The initials of the owner of the car can be cut in this cover, if desired. The lamp is intended to be placed horizontally in the roof of the vehicle, and not in the position shown in the cut. The hanging of its bulb on springs makes the latter specially durable for automobile service. Although the light is shown here with a switch upon the base, it is usually wired with a switch in some convenient place where it can be readily reached when one wishes to turn on the light. If it is necessary to run the wires on the surface of the woodwork, a polished wood back of mahogany or oak with grooves for the wires can be used. The lamp is about six inches in diameter, and projects about two inches from the roof of the carriage. It is adapted for a four, six, or eight-volt set of accumulators, and will furnish from four to eight candle-power, according to the bulb that is used. Another convenience about a car is a small electric light on a flexible cord, for use in case of a breakdown.

NEW SPRING WHEELS.

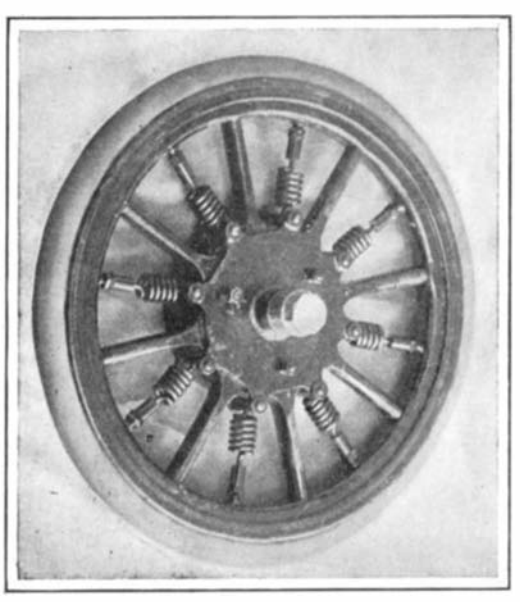
Among the new spring wheels which are coming out in France we note the S. Guigner wheel. It is manufactured by Bourgine & Lebon, of Parthenay. It has a central wood disk which carries the spokes, also of wood, and upon the wood disk are placed two metal plates carrying the axle, but being independent of it and able to allow for the play required by the springs.



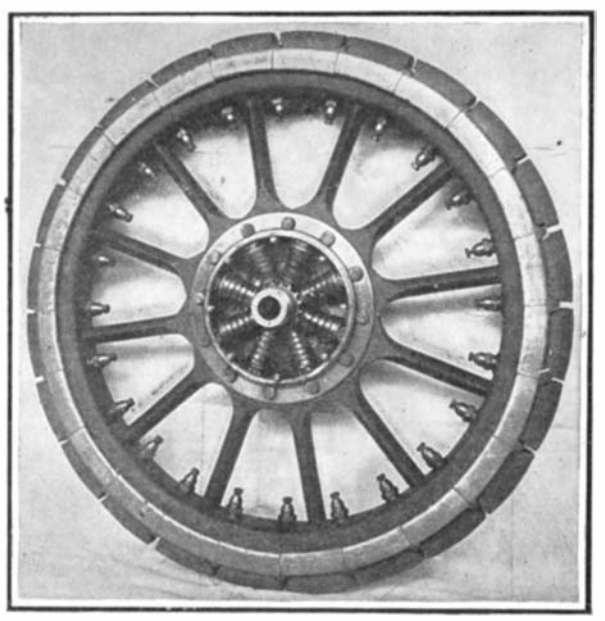
CEILING LIGHT FOR CLOSED CAR.

The two metal plates completely cover the wood disk on both of its sides and are joined by three bolts. The wood disk has large openings which allow the bolts to pass through. The metal plates are also connected at the rim by eight cross-pieces carrying the springs. The elasticity of the system is obtained by coiled springs which connect the two metal plates with the inner rim of the wheel. The springs are attached to the rim by a special device which seems to hold them in place and also to regulate the tension. The springs can be taken off in a few seconds. Owing to this construction, the car is suspended to a certain extent at the center of the wheels by means of the coiled springs, which work by traction and by compression and give a good effect in deadening the shocks. The center of the wood disk has an opening which allows the axle to take the necessary play. The three bolts connecting the two plates carry washers or separating pieces for the plates, and at each side of the bolts is a rectangular cavity in the wood piece which carries a coiled spring working against the bolt by compression, or else a rubber block serving the same purpose, so that we obtain a deadening of the shock at the time of sudden starting or a quick stop. To complete the elasticity of the system the central part of the wheel carries a heavy rubber washer or cylindrical piece which is used to complete the action of the springs at exceptional times, under a very heavy shock. By the above combination the inventor claims a very great ease of movement combined with all the desired rigidity of the wheel. The expense of keeping it in order is reduced to the changing of the rubber tires, which are solid, and it is recognized that a good solid

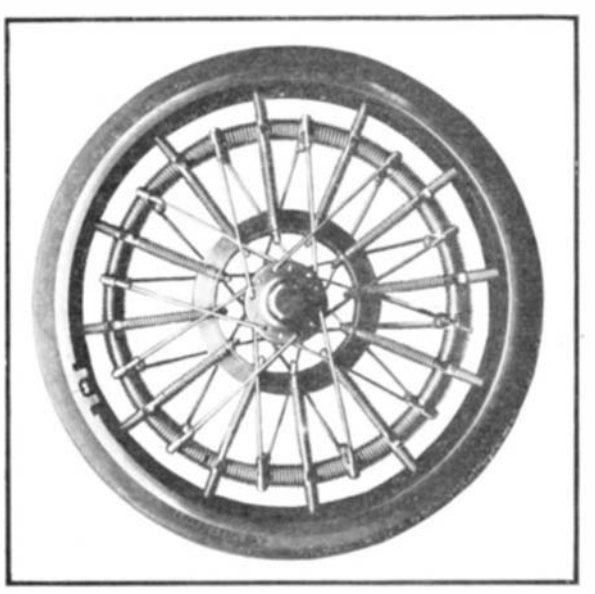
(*Continued on page* 38.)



WHEEL WITH FLOATING HUB SUSPENDED BY COILED SPRINGS FROM THE RIM.



WHEEL FITTED WITH SECTIONAL TIRE AND SPECIAL SPRING-SUPPORTED HUB.



WHEEL WITH AN INTERNAL SPRING DRIVING WHEEL.

SOLAR LAMPS

THEY CUT LIKE A KNIFE THROUGH THE GLOOM AND DARKNESS

EVERY MAN WHO DRIVES AT NIGHT MUST HAVE A GOOD CAR AND A BETTER LIGHT

LET THE SOLAR LIGHT YOUR WAY

THAT'S THE SOLAR

GET OUR BOOKLET OR ASK YOUR SUPPLY MAN

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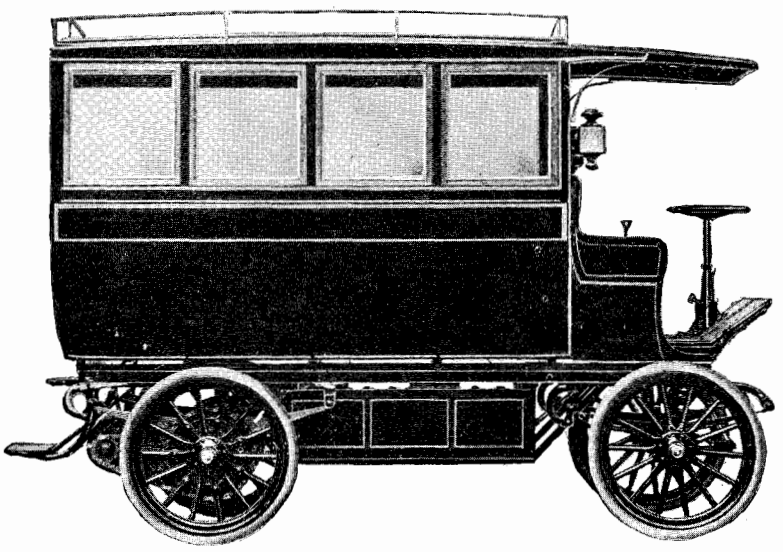

14-Passenger Electric Omnibus, Model 2012

THIS 14-passenger Electric Omnibus is a type of car we are building extensively for hotels and resorts. In impressive appearance and luxurious comfort it surpasses every previous style of omnibus.

It is constructed both in materials and mechanism according to absolutely reliable Studebaker standards, and has given a grade of service highly satisfactory to the many establishments who are operating it.

Studebaker Electrics do not run up repair bills. Send for a list of the well known users of the 14-Passenger Omnibus

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Studebaker Automobile Co.

Factory and Executive Offices, SOUTH BEND, IND.

Repositories— New York City, Broadway and 7th Avenue, at 48th Street—Chicago, Ill., 378-388 Wabash Avenue—Kansas City, Mo., 810-814 Walnut Street—San Francisco, Cal., corner Market and 10th Streets—Portland, Ore. 330-336 E. Morrison Street—Denver, Colo., corner 15th and Blake Streets—Salt Lake City, Utah, 157-159 State Street—Dallas, Texas, 317-319 Elm Street—*Local Agents Everywhere*

Witherbee Storage Battery Igniter

Now Used and Endorsed by 48 of the Leading Automobile and Motor Boat Manufacturers.

Can you afford to consider anything else for your '06 Car?

"Every Battery Guaranteed, Every Customer Satisfied." Over 12,000 Batteries now in use. Suitable for any Automobile Engine using Make and Break or Jump Spark Ignition.

Recognized as the Most Satisfactory Means of Ignition.

Every Battery Guaranteed to give Satisfaction or Purchase Money Refunded.

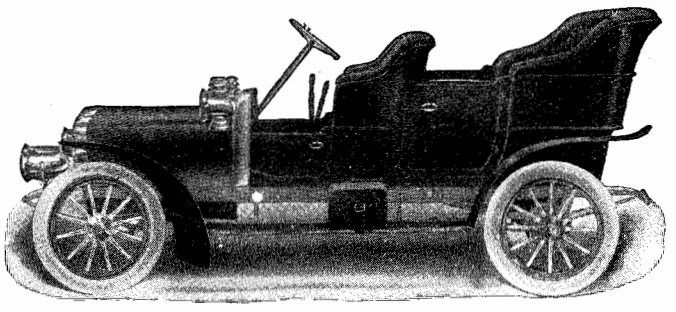
When ordering your Car insist on having the WITHERBEE and avoid all ignition troubles.

Endorsed by the Leading Manufacturers. Sold by the Leading Jobbers.

Write for Descriptive Pamphlet.

WITHERBEE IGNITER CO.

541-543 West 43d St., New York



The car of to-day, to-morrow and for years to come.
Built by practical men—

Aerocar

The ONE motor car driven by a reliable, test-proven air-cooled motor.

The motor car is not an every-day purchase. It costs considerable money, and if it does not run satisfactorily it is of little value.

There must be a good motor to make a good automobile. Water-cooled motors have many troubles—the perfect water-cooled motor has yet to come.

The perfect Air-cooled motor is here. It is the air-cooled motor of the **Aerocar.**

Because of its wonderful efficiency in power; because of the saving in weight; because of simplicity and strength in mechanical construction; because of its uniformly smooth working—runs steady with the rhythm of an electric dynamo;—because it is the same reliable sure-working motor under all climatic conditions, midsummer or midwinter makes no difference, there's nothing to freeze nor nothing to thaw;—because of ease of control, economy of maintenance; because it will develop continuous higher power, for weight, and give greater speed than any other motor; because of its assured reliability and greater durability of service.

The body of the **Aerocar** compares most favorably with any other automobile, either foreign or American. It embodies the best features of each, is graceful in design, is most comfortably roomy, is luxuriously upholstered, and finished along the strictly high standard of up-to-date demands.

We courteously ask the opportunity to give a practical demonstration of the superiority, in every way, of the **Aerocar.** Try before you buy. Know why before you put money in a motor car.

Aerocar 1906. 24 h. p. Four cylinders. Five passengers. 45 miles an hour. 104 inch wheel base. Shaft drive. Sliding gear transmission. Three speeds and reverse. Leather-faced cone clutch. Hollow steel dash. Four sight lubricator on dash. Tool box on running board. 34 x 4 tires. 9-inch road clearance. Weight 2,000 pounds. Fully equipped, ready for the road, including two large glass headlights, $2,800 f. o. b. Detroit.

Will be exhibited and demonstrated at the Automobile Shows in New York and Chicago. Write for descriptive literature G.

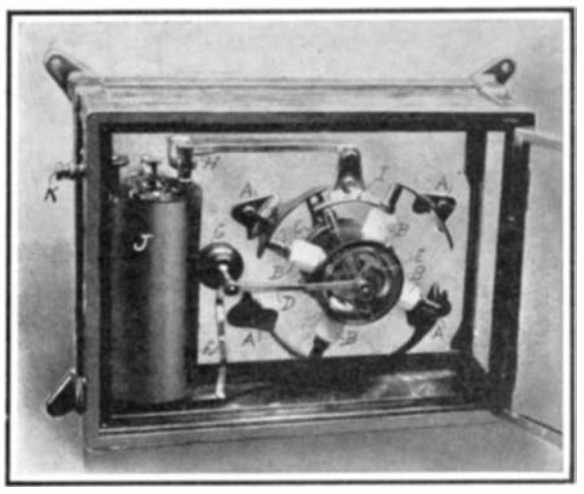
The Aerocar Company, Detroit, Mich.

NEW SPRING WHEELS.

(*Continued from page 36.*)

tire will run from 10,000 to 12,000 miles upon fairly good roads without needing repairs. The weight of the Guigner wheel is from 70 to 100 pounds, according to the size, and at present it is made in 30 to 38-inch sizes.

Another interesting effort to grapple with the problem of obviating the disadvantages inherent in pneumatic tires is the invention of Mr. George Middleton, of London. In this device, instead of the wheel rims being shod with pneumatic tires, the air cushion is inserted round the hub of the wheel, so that the wheel proper has no rigid connection with the axle or driving medium. This device has been thoroughly tested with a 15-horse-power Panhard car, the wheels of which



A NOVEL DASHBOARD IGNITION OUTFIT.

were fitted with it and shod with solid tires. Over 15,000 miles have been covered, and the system has proved fairly successful. The degree of resiliency is of course not equal to that of pneumatic tires, but it has the surety that a puncture is a very remote possibility. Should, however, the air cushion break down, the car can still be safely run to its destination where the defective tube can be repaired. Access to the tube can be effected quickly and easily since the outer flange is made removable for this purpose. Several high-powered cars have already had this pneumatic hub fitted to the driving wheels, so that the latter can be shod with solid tires, and the conversion has proved completely successful.

A wheel having a hub somewhat similar to the above-described wheel, but in which the hub is supported on springs instead of on a pneumatic tube, is also shown at the bottom of page 36. This wheel is provided with a solid tire put on in sections, which are held to the rim by special binding screws. The arrangement is a compact one and it has a very neat appearance.

A somewhat more complicated wheel, designed for a like purpose, consists of a hub tied by tangent spokes

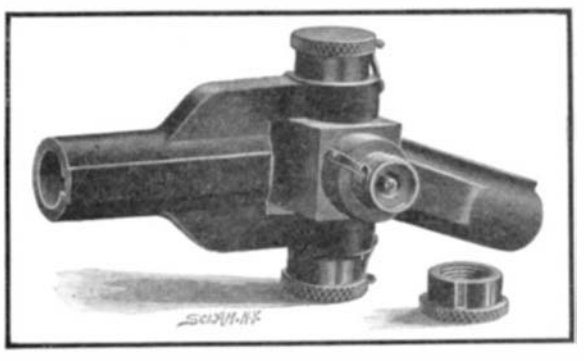


Fig. 1.--UNIVERSAL JOINT ASSEMBLED.

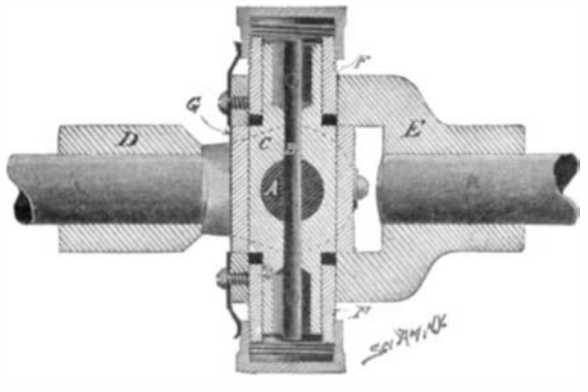


Fig. 2.—SECTION THROUGH JOINT.

to a ring surrounded by an annular coiled spring, and situated within the rim of the wheel. This ring is straddled by twelve radial rods connecting the rim of the wheel with a metal ring surrounding the hub, and these rods also have coiled springs acting under compression. The inner ring having the annular coiled spring may be considered an inner driving wheel, for as the axle begins to turn, the spring is compressed against the radial rods or spokes, thereby giving a spring-drive to the rim. The straight coiled springs which run to the rim act as shock absorbers or spring cushions which take the place of pneumatic tires.

Roman Antiquities Discovered in London.

Another section of the ancient Roman wall has been brought to light during the construction of a factory in the City of London. The unearthed relic measures 20 feet in length by 7 feet in height. Owing to its extreme antiquarian interest, the wall is not to be demolished, but is to be left in position, the new factory being built around it. It will then project about three feet into one of the rooms on the lower ground floor. To protect the wall from crumbling under the vibration of machinery and other causes, it is to be inclosed in a galvanized-iron netting similar to that around the Roman remains at the London Coal Exchange. In the course of other excavations upon the site for a fire station in Cannon Street, a Roman bath was unearthed. The relic is in a perfect state of preservation and is quite complete. It measures inside 10 feet 6 inches in length by 6 feet 3 inches wide, and weighs about seven tons. This monument has been removed intact, and will eventually be placed in a museum.

A DASHBOARD IGNITION OUTFIT.

In the Mosler ignition device, illustrated herewith, all parts of the electric system of an automobile except the batteries, spark plugs and connecting wires, are carried in a brass-framed glass case attached to the dashboard. The case contains the coil, a primary interrupter, and a secondary distributor, and these are always visible, thus permitting adjustments and repairs with little loss of time.

The wire from the batteries connects through the binding post, *K*, with the primary of the coil, *J*, while the other end of this winding is joined through the contact, *H*, with the fixed sector, *I*, on the rear wall of the case, *I* being connected through the brush post, *C*, with the four segments of the primary interrupter. The primary circuit is completed through the grounded shaft and car body to the batteries.

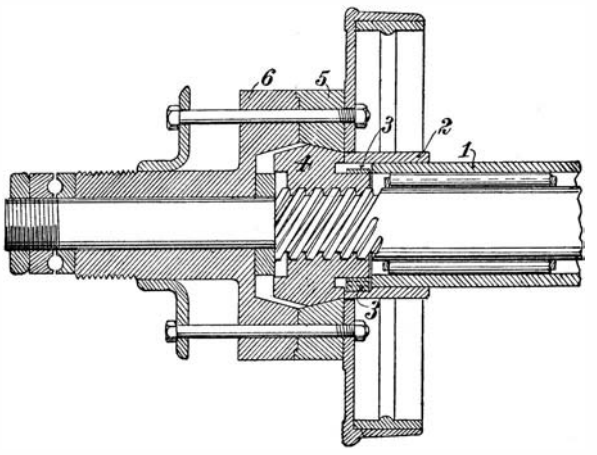
One terminal of the secondary coil winding is grounded through the same post as the primary, while the other connects with a brass strip, *F*, carried by the hard rubber support, *G*. From this the current is carried to a central terminal, *E*, of the distributor by a movable flexible rod, *D*, which is so hinged at the bracket end that it can be swung from the terminal, *E*, to permit the opening of the circuit. The high tension circuit from *E* is through revolving ball contact with the rotating T-shaped brush. The outer ends of the four high-tension terminals which are inclosed in the insulations, *B*, are in direct contact with the four segments, *A*. These are secured to the rear panel of the casing and are connected to the four wires to the spark plugs.

AN IMPROVED UNIVERSAL JOINT.

A universal joint has recently been invented, which is so designed that it can be taken apart without the use of tools. One of our illustrations shows the complete joint with one of the grease cups removed, while the other is a section which clearly shows the novel construction. It will be observed that the joint comprises a central cubical block, *G*, through which passes a shouldered pin, *C*. A hole is drilled transversely through this pin and the block to receive the pin, *A*. A small locking pin, *B*, passes lengthwise through the pin, *C*, and transversely through pin, *A*, serving to hold them together in proper relative position. The projecting ends of these pins find bearings respectively in the forks, *E* and *D*, which are carried on the two sections of the shaft. Bushings, *F*, are driven into the holes in the forks, and the threaded ends of these bushings carry the grease cups. Spring stops on the forks press against the cups to prevent them from working off the bushing. Packing rings at the bottom of the bushings prevent the escape of the lubricant, which is kept in holes drilled in the ends of the pins, *A* and *C*. When it is desired to take the joint apart, two adjacent grease cups are removed. The pin, *B*, is then removed, permitting the pin, *A*, to drop out, whereupon the joint falls apart.

WHEEL CLUTCH FOR USE WITH A SOLID REAR AXLE.

Many attempts have been made by inventors to devise some sort of a clutch for use on the rear axle of an automobile, which would do away with the complications and deficiencies of the differential gear. We illustrate herewith a simple clutch which appears to have solved the difficulty. The rear axle turns on roller bearings, carried by the housing, 1. The sleeve, 2, on this housing carries a friction band, 3, which is mounted on the hub of the nut, 4, and is free to move in and out with this nut. The nut engages a thread on the axle. It will be observed that the periphery of the nut is formed with inclined faces adapted to engage one or other of the clutch faces on the hubs, 5 and 6. The illustration shows the nut engaging the "go-ahead" clutch, 5. If, as in rounding a curve, the outer wheel travels faster than the axle, it tends to feed the nut out to a neutral position between the two faces. When the motion of the axle is reversed, the thread feeds the nut back against the clutch, 6, and then again, if the wheel travels faster than the axle, the clutch feeds the nut in far enough to disengage the clutch faces. As a result of this construction, the wheel which is doing the harder work receives more power, whereas with a differential axle the wheel which is doing the less work is favored at the expense of the other. An extreme example is that of a machine equipped with a differential axle standing

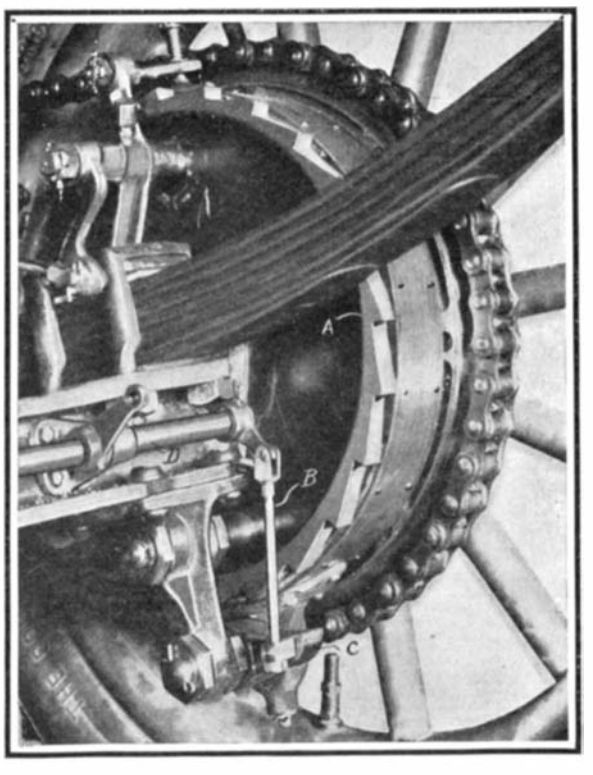


AUTOMATIC WHEEL CLUTCH MAKING POSSIBLE A SOLID LIVE AXLE.

with one wheel on dry pavement and the other on a muddy or wet spot. The latter wheel will spin idly around while the other remains stationary. The improved axle here shown would make both wheels turn at the same speed, expending the greater power on the wheel which engages the dry ground.

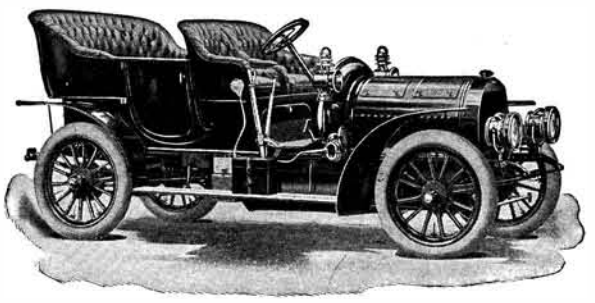
THE THOMAS SAFETY RATCHET DEVICE.

One of the most striking features of the Thomas car is a safety ratchet device arranged on the brake drums of the rear wheels and having for its object the instant stopping of the machine should the brakes fail to hold and the car start to run down hill backward. By the movement of a small lever placed on the dash, the driver rotates the rod, *D*, and, by means of the connection, *B*, draws up the pawl, *C*, against the ratchet-toothed ring, *A*. *C* is held against *A* by means of a spring suitably connected in the system, with the result that if the car is backing, it is instantly brought to a standstill and its passengers are saved from disastrous results. This device is a valuable one, and should be placed on more of the large touring cars, as failure of the brakes in a critical moment is one of the troubles to which such cars are prone. The



THOMAS SAFETY RATCHET DEVICE FOR STOPPING A CAR FROM BACKING DOWN HILL.

1906 Thomas is as commodious a car as heretofore. It has a 5½ x 5½, 4-cylinder, 50-horse-power motor, 34 x 4½-inch tires, a 118-inch wheel base, and weighs in the neighborhood of 3,000 pounds. Every car is sold under a guarantee that it will develop a speed of 60 miles an hour.



The wonderful motor in each Royal Tourist is exactly the same as the one that ran away from most of the racing cars in the Vanderbilt Elimination Race.

COMFORT *SPEED* *SAFETY*

40 H. P. *1906 Model G* *$3,500*

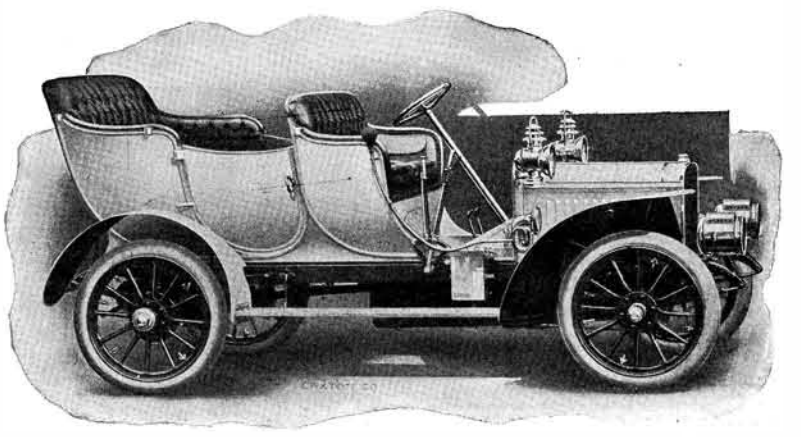
ROYAL

The Royal Motor Car Company
Cleveland

Member A. L. A. M. Send for Catalogue

Cleveland

Model F
30-35 H.P.
5 to 55 miles per hour on third speed. Guaranteed for one year



SHOWING THE CLEVELAND MODEL F EQUIPPED WITH STANDARD VICTORIA BODY
TULIP BODY FURNISHED IF DESIRED

The buyer of a MODEL F CLEVELAND can safely eliminate the cost of repairs as a factor. Its economy is a tangible asset, due to harmony of strength, design and construction.

The repairs on fifty 1905 cars in constant use averaged $4.00 including time. One Boston car ran 6,000 miles at a repair expense of $3.90. One New York car 9,000 at a repair expense of $6.00—$4.00 of which was for spark plugs.

The CLEVELAND has real, solid, tested, standing-up ability. The complete chassis is made by the Garford Company—the largest manufacturers of exclusively high grade automobile parts and chassis in America. *It has no weak spots—we guarantee you against them.* Price $3,500 to $5,000, depending upon body equipment.

The ignition is by the imported Simms-Bosch low tension Magneto, with which all important foreign cars are equipped. The spark is make and brake and controlled by the speed of the engine—doing away with the spark plugs, coils, intricate wiring and batteries.

The carburetor is automatic and requires no adjustment. It will not flood. The exhaust on the muffler prevents dust from coming in the rear of the car.

Our catalogue illustrates and describes in detail the wonderful mechanical construction which makes the CLEVELAND a year ahead in American Automobile building. FREE on request.

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REO

REO 1906 Touring Car, 16 h. p., 1600 pounds, 90-inch wheel base, 5 passengers, side door detachable tonneau. Speed 35 miles per hour, $1250

The Car That Did. The Car That Will.

No cars have ever scored a more remarkable series of real victories than was won in their first short season by REO Cars.

In the great six-day Economy test they won the First and Second Gold Medals and three other prizes: Five out of seven.

In this test a REO car carried its load **nearly 200 miles;** at a total cost of 35 cents a passenger.

On Paddock Hill, Cincinnati, a **REO** Touring-car won three cups in one day, beating all of the twenty competing 4-passenger gasoline cars; including eight of the 24-horse power rating and double the REO'S price.

In the Los Angeles Dealers' Run; in the Glidden Tour; in the Mt. Washington "Climb to the Clouds" and on the Syracuse and Empire City race tracks REO cars broke the reliability, economy, climbing and racing records; and leapt at one bound into the front rank of star performers.

REO cars stand up to practical every day work without trouble or complaint.

What REOS have done REOS will do.

Write for the REO book that tells why.

REO 1906 Runabout, 8 h. p., 900 pounds, 2 passengers, 25 miles per hour. $650. With folding seat, $675.

We exhibit at the Old Show in the New Armory, January 13th to 20th.

REO Motor Car Co., Sales Department, Lansing, Mich.

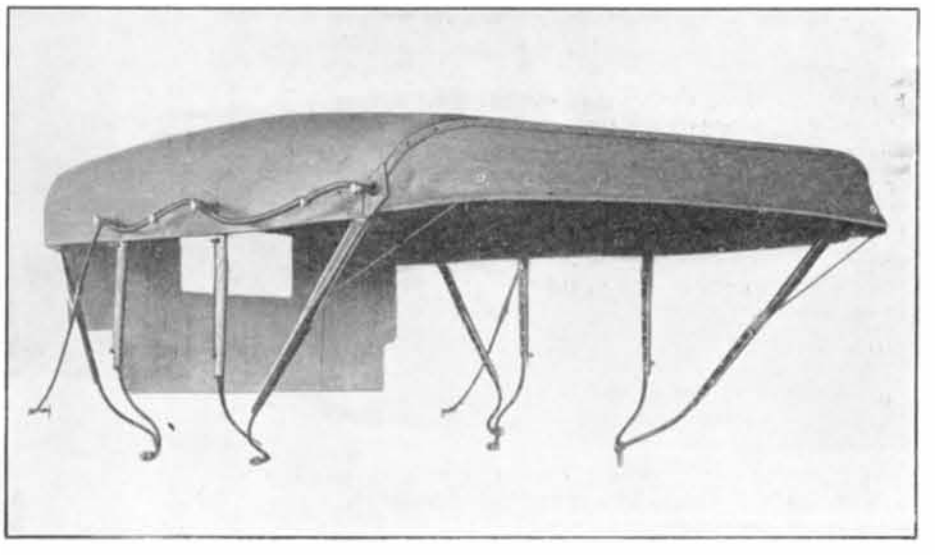
R. E. OLDS, President. **R. M. OWEN, Sales Manager.**

Agencies throughout the United States.

The Sprague Auto Tops

SCIENTIFICALLY MADE

THE SPRAGUE IDEA MADE THE SPRAGUE WAY



OUR NEW TOP

See the curved irons on the bows. This is the only right way to make the bows; **they are straight on the lower ends.** The drop forgings will stay in place, and they make a neat, substantial job. See them at the shows. Ask for Colonel Sprague.

Send for our catalogue.

THE SPRAGUE UMBRELLA COMPANY
NORWALK, O.

The Wright Aeroplane and Its Fabled Performances.

A Parisian automobile paper recently published a letter from the Wright brothers to Capt. Ferber of the French army, in which statements are made that certainly need some public substantiation from the Wright brothers. In the letter in question it is alleged that on September 26 the Wright motor-driven aeroplane covered a distance of 17.961 kilometers in 18 minutes and 9 seconds, and that its further progress was stopped by lack of gasoline. On September 29 a distance of 19.57 kilometers was covered in 19 minutes and 55 seconds, the gasoline supply again having been exhausted. On September 30 the machine traveled 16 kilometers in 17 minutes and 15 seconds; this time a hot bearing prevented further remarkable progress. Then came some eye-opening records. Here they are:

October 3: 24.535 kilometers in 25 minutes and 5 seconds. (Cause of stoppage, not bearing.)

October 4: 33.455 kilometers in 33 minutes and 17 seconds. (Cause of stoppage, hot bearing.)

October 5: 38.956 kilometers in 33 minutes and 3 seconds. (Cause of stoppage, exhaustion of gasoline supply.)

It seems that these alleged experiments were made at Dayton, Ohio, a fairly large town, and that the newspapers of the United States, alert as they are, allowed these sensational performances to escape their notice. When it is considered that Langley never even successfully launched his man-carrying machine, that Langley's experimental model never flew more than a mile, and that Wright's mysterious aeroplane covered a reputed distance of 38 kilometers at the rate of one kilometer a minute, we have the right to exact further information before we place reliance on these French reports. Unfortunately, the Wright brothers are hardly disposed to publish any substantiation or to make public experiments, for reasons best known to themselves. If such sensational and tremendously important experiments are being conducted in a not very remote part of the country, on a subject in which almost everybody feels the most profound interest, is it possible to believe that the enterprising American reporter, who, it is well known, comes down the chimney when the door is locked in his face—even if he has to scale a fifteen-story sky-scraper to do so—would not have ascertained all about them and published them broadcast long ago? Why particularly, as is further alleged, should the Wrights desire to sell their invention to the French government for a "million" francs? Surely their own is the first to which they would be likely to apply.

We certainly want more light on the subject.

AUTOMOBILE SHOCK-ABSORBERS.

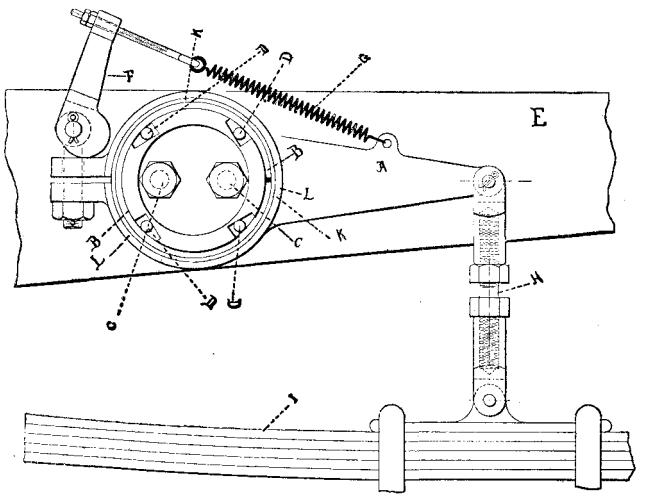
Devices for easing the shock to the springs and checking the rebound of the same are daily becoming more numerous. The original device of this sort was first used on the Richard-Brazier racer, which won the Gordon-Bennett race in 1904. This was the Hartford-Truffault suspension, which has since been widely used on all makes of cars. It consists, in its latest form, of two flat lever arms pivotally attached to the lower part of the spring, where it is clamped to the axle, and to the body respectively. These lever arms terminate in flat disks, which are fastened together by a central bolt, and which clamp a leather washer between them. A five-pronged starwheel on the outside of one disk is used for adjusting the pressure, and is locked in place by a lock nut. The turning motion of the disks on the friction washer, which takes place when the spring is compressed (bringing the two arms together) or when it recoils (throwing the arms apart), produces a braking effect upon the spring, which adds greatly to the easy-riding qualities of the car.

Another form of shock-absorber which has been patented lately consists of a pneumatic pad placed on the axle and having the spring resting upon it. This pad absorbs all the vibrations, and makes it possible to use solid tires on the wheels.

Still another new device for checking the rebound of the spring is shown herewith. The action of this apparatus is as follows:

To the frame of the car is fastened a central disk, by bolts, *C C*. This disk has four cam slots in its periphery, in which are the rollers, *D D D D*. Bearing on these is a steel friction band, *B*, split crosswise to give a certain elasticity as the rollers come and go. Surrounding this band is a fiber band, *K*, which takes the thrust between *B* and the split hub, *L*, of the arm, *A*. The back end of the hub is split and has two extending lugs. Secured in the lower lug is a bolt, which passes freely through the upper lug. Bearing on this lug and pivoted on the bolt is a cam with the upwardly extending arm, *F*, which in turn is connected to the arm, *A*, by the helical spring, *G*. This spring is adjustable in its tension by virtue of the rod passing through *F*. The arm, *A*, is connected by the adjustable rod, *H*, to the spring, *I*, of the car.

When the car goes over a bump, the frame, *E*, moves toward the spring, *I*, and consequently throws up the arm, *A*. This action is without resistance on the part of the device. When the frame and spring tend to separate, however, the four rollers engage with the friction band, *B*, and cause a braking action to take place between the friction band and the fiber band. The tension on the brake is at all times self-adjusting both as to tension and wear, by means of the cam bearing on the upper lug of the split hub and the spring, *G*, the degree of tension being governed by the eyebolt passing through *F*. Thus is obtained a self-

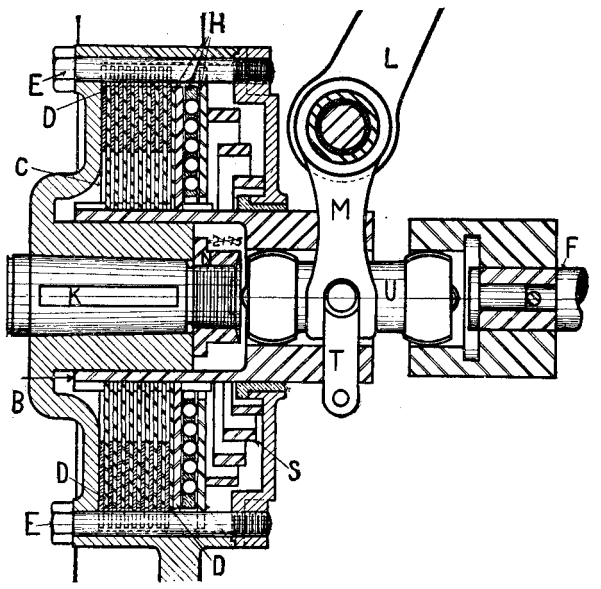


AUTOMOBILE SHOCK-ABSORBER.

adjusting suspension, which only checks the rebound of the spring, allowing it to act without hindrance when deflecting.

THE FRANKLIN AIR-COOLED CARS.

The latest type of Franklin machine is a 6-cylinder, 30-horse-power car, fitted with a 3-speed sliding gear transmission and capable of traveling 50 miles an hour. The engine of this car has mechanically-operated inlet and exhaust valves, as well as auxiliary exhaust valves of the same type. The cylinders are of uniform thickness, and the head has been decreased in thickness over that used last year. The inlet and exhaust valve chambers in the top of the cylinders are flanged with radiating ribs. The auxiliary exhaust valve is said to be beneficial in three ways, viz.: It gives a much freer exhaust, which reduces the back pressure and lowers the temperature of the remaining gases; the main exhaust valve is not subjected to such a severe flame, because the pressure in the cylinder has been lowered; and lastly, no carbon deposits form in the combustion chamber, and the cylinders never become fouled through surplus oil. Graphite may be used in the crankcase, if desired. The diagram showing the cross section of the Franklin clutch gives a good idea of a multiple-disk clutch, such as is now being used on many of the leading cars. The disks are of phosphor-bronze and steel, the former, *C*, being prevented from rotating in the flywheel by the bolts, *E*, on which they are mounted so that they have lateral movement. The other disks, *D*, are located between the first set and are fastened to the clutch sleeve, *B*, on which they can move laterally. This sleeve is connected to the transmission shaft by means of the universal joint, *U*. A flat spiral spring, *S*, holds the plates firmly in contact when the clutch is engaged. As the flywheel revolves, it carries with it the first set of disks, *C*, and these also carry along the second



CROSS-SECTION OF THE FRANKLIN CLUTCH.

set of disks, since all are pressed together by the spring, *S*. When the pedal lever, *L*, is moved forward by means of pressure on the clutch pedal, the clutch-shifter lever, *M*, is moved backward, carrying with it the trunnion, *T*, and the clutch sleeve. The latter brings with it the ball thrust bearing, *H*, consisting of three plates, the center one of which contains a large number of balls. This thrust bearing compresses the spring, *S*, relieving the pressure upon the disks, which are now free to move, and which separate sufficiently for the oil from the oil bath in which the clutch runs to fill the space between them. A certain amount of time is taken for the oil to be squeezed out when the disks are thrust together again by the spring, and the result is that the clutch takes hold gradually and without jerk.

Automobile Notes.

A comprehensive idea of the proportions of the automobile industry in France may be gathered from the fact that in that country there are twenty large motor car manufactories devoted to the production of automobiles, and their average daily output is two vehicles, representing 14,400 vehicles per annum. To these must be added the output of fifty smaller establishments, which produce on the average 9,000 vehicles per year. France has thus an annual total production of over 23,000 motor car chassis, exclusive of carriage bodies and outfits. A large proportion of this production is exported, some 7,000 annually being sent to England, of which a large percentage is re-exported to the colonies. Other countries are also good customers of this prominent French industry.

The proper degree of inflation of the pneumatic tires for automobiles of large size exercises a far-reaching influence upon the life and durability of the tires. A tire insufficiently inflated is short-lived, owing to the rim of the wheel tending to break the beaded edge of the tire from the tread, while excessive inflation maintains the fabric at such a tension that disintegration of the fabric must inevitably occur very quickly. The correct pressure, according to the most prominent manufacturers, should be in the case of the tires for the front wheels from 70 to 80 pounds per square inch and from 80 to 90 pounds for the rear wheel tires. If this pressure is not adhered to a very severe contracting and expanding action takes place just above the point of contact all the time the tire is rolling over the ground, with the result that enormous friction is set up. This causes considerable heating of the walls of the tire with the results of cracking and bursting. To make sure that the pressure is correct, a good pump with a gage should be used, and it is advisable that the latter should be tested from time to time to insure that it is registering correctly.

Accumulator design has recently experienced a radical change by the appearance on the market of the new "Morrison" storage battery, which is manufactured by the Universal Electric Storage Battery Company, of Chicago. The designers of this battery have departed from accepted practice in an attempt to avoid one of the principal causes of depreciation, viz., the shedding or gradual loss of active material from the positive plates. In so doing, they have not only successfully accomplished the results desired, but in addition have gained a noticeable increase in capacity per unit of weight. These departures from the older and better known designs are embodied in a peculiar construction of positive plate. This is made up of twenty or more horizontal rectangular frames, whose length is equal to the width of the plate and whose width is the same as its thickness, i. e., about ½ inch, while their height is somewhat less. These frames have numerous transverse ribs, the spaces between which are filled with active material, thus making each frame a solid rectangular block. These blocks are assembled one above another with transversely-grooved wood separators of the same size placed between them. Vertical side bars dovetailed and lead burned to them tie them together so as to form a complete plate. The result is a plate of unusual mechanical strength in which the active material is totally inclosed, and consequently the possibility of loss from the plate eliminated. By this construction the manufacturers are able to employ a very high percentage of active material per pound of plate. Complete expansion of active material is assured before the sections are filled, and no mechanical pressure is required to hold the active material in place, as is the case with other forms of pasted plate. The active material is consequently left in a very porous condition, allowing good circulation of the electrolyte. As it is within the plate, and surrounded by the lead grid, the elements of the battery can be assembled with the metallic surfaces of positive and negative plates close together, instead of the active material being on the surface, and the lead in the interior. The internal resistance of the cell is accordingly greatly reduced. The manufacturers of the "Morrison" battery claim for their output absolute retention of the active material, giving durability and continued full capacity; large active surface and great porosity of active material for the action of the electrolyte, giving great ampere capacity per pound; better circulation for the electrolyte; two metallic surfaces opposite each other, giving the lowest internal resistance of any cell; great mechanical strength; entire freedom from buckling. The company have in constant service a great number of their batteries used for train lighting, truck, and automobile work, all of which are said to be giving entire satisfaction.

Every man who has cut his automobile eye-teeth, who has mastered his abc's in the school of motor experience, knows that a whole lot depends upon the *maker*, *after* the car is his.

The nimble tongue of the salesman maketh many boasts, and his unblushing assurance giveth the purchaser much hope.

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This much is certain: Every maker guarantees *all he safely can*, for, to the experienced buyer, it is the *guarantee* that sells the car, *not* airy, fairy promises.

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The weight is equalized and so perfectly distributed that the strain, coming upon *all* parts, really reaches *no* part. The load is cared for by re-enforced springs and roller bearings, swimming in lubrication, so that it just about carries itself.

The motor is of special type, 4½ x 5 inches, 4-cylinder; water cooled; sliding gear transmission; three speeds and reverse. **Selective type,** can change from high to intermediate, or *vice versa*, at speed of 25 miles, without clashing or noise, up hill or down; practically noiseless; entire transmission on roller bearings; mechanical lubrication; 30-35 horse-power. Proportion of power to weight, one horse-power to every sixty pounds. $2,250.

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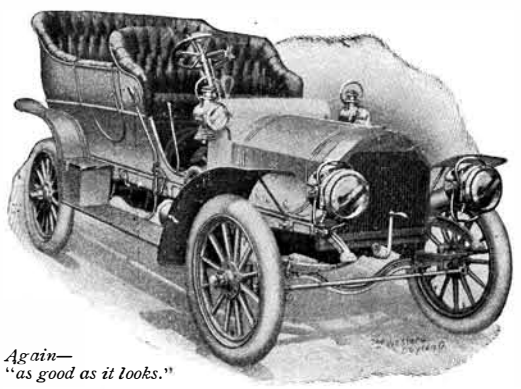

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ARE built of the best materials in the world under methods and processes more advanced than those employed in any automobile factory other than our own. No consideration of the cost of production has been permitted to interfere with making perfect every part and piece of each model, whether pertaining to mechanism, bodywork or general equipment. The expense of making the crankshafts, for instance, is six times greater than that of any previously made in this country. We guarantee that these cars, each according to its power and place, will yield the greatest things possible in motor service.

Mark XLVII 40-45 h. p. four-cylinder motor under forward bonnet; sliding gear transmission, four speeds, and one reverse; jump spark ignition from storage battery; new pattern automatic carburetor; spacial chrome-nickel steel gears, axles, crankshaft and jackshaft; crankshaft machined cold out of solid block; double chain drive; I-beam front axle forged in one piece; pressed steel frame; 108-inch wheel base; seat starting; new pattern brakes. Price, with standard body $4,500
With 112-inch wheel base, Royal Victoria, Double Victoria, Limousine or Landaulet body, $5,000 to $5,500

Mark XLVI An entirely new model, 24-28 h. p. four-cylinder, vertical water-cooled motor; shaft-drive; sliding gear transmission, three speeds and reverse; low tension make and break magneto current ignition; special chrome-nickel steel gears and shafts, crankshaft machined cold out of solid block; I-beam front axle forged in one piece; rotary pump oil lubrication; pressed steel frame, 98-inch wheel base; double side entrance body seating five passengers. Price $3,000

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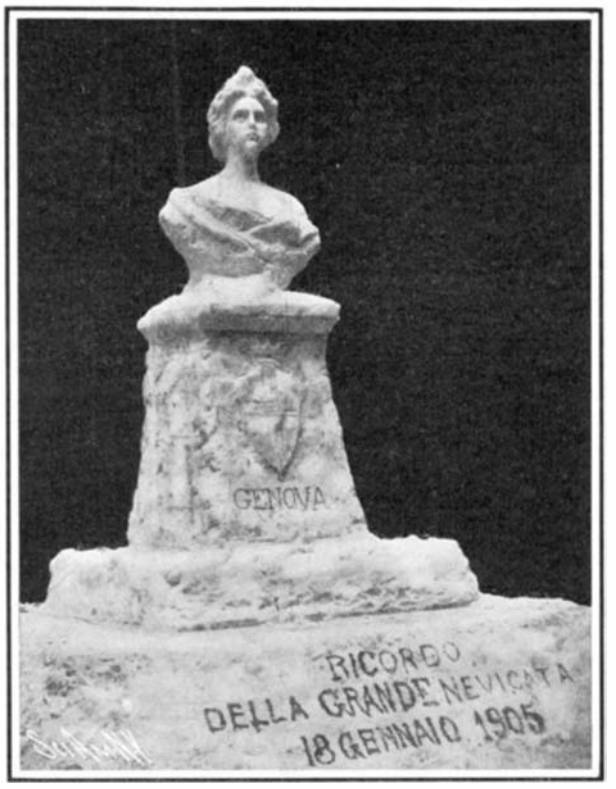
SNOW SCULPTURES.

BY DR. ALFRED GRADENWITZ.

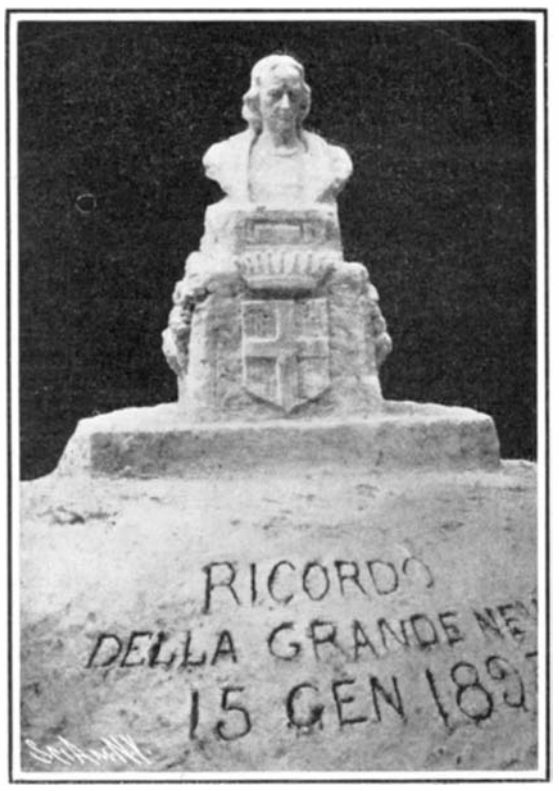
There is some ground for the statement that snow is the most widely used material for modeling, though the latter, it is true, is generally of a very primitive description. In practically every country where the snowfall is sufficiently heavy, the boys of the cities; as well as their brothers of the country districts, at the arrival of winter proceed to form the glittering white masses into coarse shapes, which an active fancy will recognize as the representations of men or animals. In some localities this sport is developed to a fairly high degree, and entire communities, young people and old, often take a hand in the healthful pastime. In the Harz Mountains of Germany, for instance, attractive groups of snow sculptures are sometimes encountered, though these productions never attain the level of true art.

An Italian sculptor, Signor Achille Carressa, of Genoa, who has become famous through his Columbus monuments designed for certain South American cities, was one of the first to accomplish the task of producing snow representations of truly artistic value. The southern home of the artist bids fair to surpass parts even of the north of Europe in the rigidity of its climate, and with the first heavy snowfall Signor Carressa quickly installs his studio on the neighboring Piazza San Giro, and surrounded by the wondering crowd, he produces these charming examples of the plastic art, which by their delicacy of design and execution are little inferior to marble sculptures.

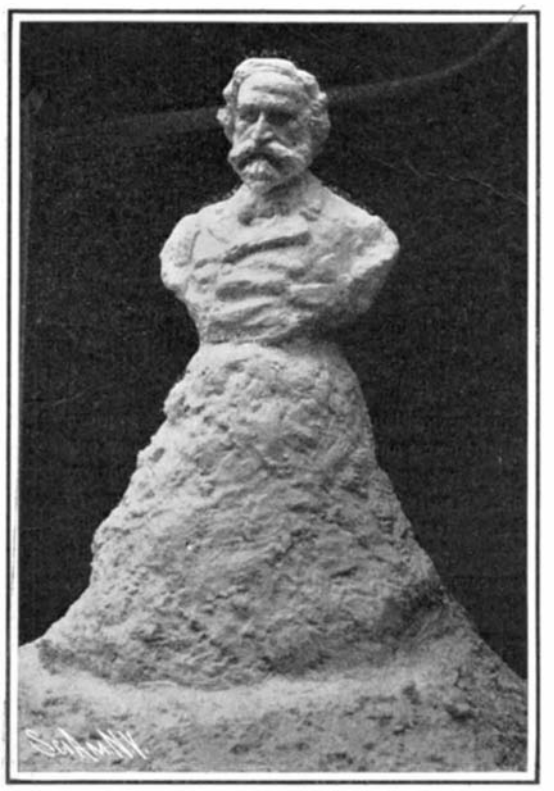
The accompanying engravings illustrate several of these works of the Italian artist. The latest production is the statue of Genova, patroness of the city of Genoa. The inscription reads: "Record of the Great Snowfall of January 18, 1905," and a splendid, though fragile souvenir the statue is. It is truly unfortunate that the only means for preserving these works of art is through the agency of the camera.



Genova, the Patroness of Genoa, Made After the Snowfall of January 18, 1905.



A Characteristic Bust of Columbus by Signor Carressa.



A Striking Likeness of the Italian Composer Verdi.

The Money of Savages.

BY HENRI COUPIN.

Many savage tribes know no commerce except the direct exchange of one useful object for another, but numerous other tribes have experienced the necessity of facilitating business by the creation of a standard currency which enables exchanges to be made indirectly and at any time. This money varies greatly in character in different places. Sometimes it has only an arbitrary value, sometimes it is also available for use as ornaments, or otherwise.

The money most commonly employed by primitive peoples consists of useful objects. Examples are: Slaves (in Africa and New Guinea), cattle (reindeer among the Lapps), salt (in Laos), furs (in Siberia), cloth (in Africa), shells, beads, feather and other ornaments, and even various articles of food.

If the money is not useful in itself it must naturally be composed of rare materials. "Thus the Pellew islanders," says M. Deniker, "carefully preserve as current money (andou) a certain number of obsidian or porcelain beads and prisms of terra cotta, imported no one knows when or how, which have very high values. One tribe possesses a single prism of clay (called baran) which is regarded as a public treasure. In the neighboring island of Yap the place of money is taken by blocks of aragonite, a mineral which is not found in the island but is brought from the Pellews. The value of a block is proportional to its size, a thousand-franc note ($200) being represented by a huge disk which two men can hardly carry. These stones serve rather to flatter the vanity of the wealthy natives, who exhibit them in front of their huts, than to facilitate barter."

But this is an exceptional case. Usually, preference is shown for more convenient objects which combine a maximum of value with a minimum of weight. For example, the Chorchon and Bannock Indians of Idaho and Montana use teeth of the wapiti deer as money. For the same reasons Scandinavian tribes, like the ancient Carthaginians, employ as money the skins, and the Michmis make use of the skulls, of animals, while the money of the Loyalty Islands consists of ropes made of fox hair, which may be cut to any desired length. The Mexicans formerly made extensive use of cacao beans and this sort of money is not yet entirely obsolete, despite modern facilities of communication.

Shells are often used as money. According to M. Deniker, the tooth shell, or "elephant's tusk," is thus employed by the Indians of northwestern America. The wampum beads of the tribes of the eastern United States are made of the shells of *Venus mercenaria*, a species akin to the cockles, etc.

But of all shells the cowry is most used as money. The species most frequently employed are *Cyprea moneta* and *Cyprea annulus*, of which the former appears to be commonest in Asia, the latter in Africa.

Both species occur throughout the Indian Ocean, but they are gathered in large quantities in only two districts, the Maldive islands, west of Ceylon, and the Sulu archipelago, between Borneo and the Philippines. On the Asiatic continent they are used as money most extensively in Siam and Laos, where, twenty years ago, from twenty to thirty cowries were equivalent to one centime (100 to 150 to a cent).

Tropical Africa, however, is the true realm of the cowry—a fact which is explained by its rarity. The shell is not found in the Atlantic and it has traversed the continent from Zanzibar, on the east, to Senegal, on the west coast, solely in consequence of commercial relations. Such relations must have been established at a very early date, for Cadamosto and other Portuguese explorers of the fifteenth century speak of the use of cowries as money among the "Mames" of Senegal. In Africa the exchange value of the cowry is much higher than in Asia, a fact which indicates that it is imported. The cowry was probably introduced to the east coast of Africa by the Arabs. Subsequently the importation was carried on also by Europeans. The cowry is still current money throughout the west coast of Africa as far as the River Conanza in Angola. Farther south, in the region extending to Walrus Bay, we find another variety of "shell money," consisting of fragments of a large land shell, *Achatina monetaria*, strung in cords. This money is manufactured chiefly in the Selles district in the interior of Benguela, whence it finds its way throughout the coast and even to London. The strings of shells are about 20 inches long and were worth, fifteen years ago, from 10 to 30 cents each.

Among articles of food employed as money the most important are rice in the Philippines, bricks of tea in Mongolia, and lumps of salt in central Africa, where this indispensable substance is very rare.

Iron, bronze, and other metals are very widely used as money. They occur in many forms, from simple rods and crosses to the circular coins common among civilized peoples. Sometimes the form is such that any desired value may be obtained readily by cutting. In central Africa, for example, debts are paid in brass or copper wire, and bars of silver are current money in China.—Translated for the Scientific American from La Science au XXme Siècle.

The Blessings of Cold.

In the Medical Era for October, Dr. Robert Peter maintains that cold is a blessing when you learn to endure it. He points out that its endurance can be acquired gradually if begun early in the season. He does not believe in coddling the body with woolens. "Better keep blood in circulation by outdoor exercise," says he, "so that if heavier clothing should really be needed the body will not require its encumbrance too much."

Graduated baths, with friction, he tells us, will harden the body very much, especially when followed by vigorous exercises in graded temperatures. "I know a man," says he, "who is always astir and who wears not even a shirt, but only blue jeans and blouse, all the year round. He has his windows open all the year round, day and night, no fire, and thoroughly enjoys it. While this is an extreme case, it shows how one can inure himself to cold."

Dr. Peter expresses the conviction that the subjects of ventilation and heating, which are important factors in the winter months, are not as well understood as they might be, and he attributes much of the illness during the inclement part of the year to the foul air and fuel gases, to which the baneful effects of indoor life are mainly due. According to him conditions should be reversed, and it would be wiser to camp out and bask in the winter sun and to stay at home in the summer shade.

"As to ventilation," says he, "it can never be overdone, and especially is this true at night. Our bedrooms should be well ventilated. One-third of our lives is spent in them. A bedroom with southern exposure is probably best in winter and it is a cheer and godsend. It is death to germ life. It will cut short a cold or catarrh and the white plague cannot lurk there. As we need the shade in summer, we need the sun in winter."

After a consideration of the diet, which should be more stimulating at this season of the year, the author emphasizes the fact that the respiratory organs mostly stand the brunt of the winter diseases. The doctor believes that we must look to the circulation to help us out in our prophylaxis. "After a cold is once contracted, however," he says, "open the flood gates of elimination and equalize the circulation. A good physic or a Turkish bath may restore conditions."

In recent years the construction of railways proceeded in Germany at the rate of about 621.5 miles per annum. The entire mileage exceeds at present 34,183 miles. The electrification of railways is still confined to a few suburban lines, where the system works satisfactorily. The question of long-distance electric railways is still being studied, but no decision has been arrived at so far. Plans are said to be under consideration for the introduction of electric services between Düsseldorf and Cologne—23 miles—and Berlin-Hamburg—185 miles.

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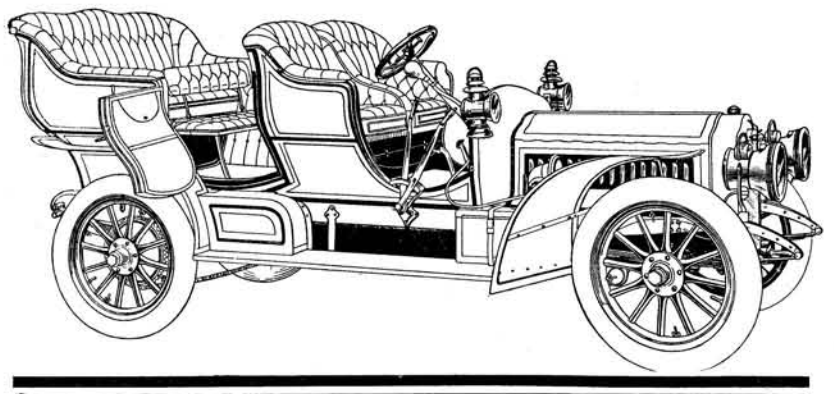
Fifty-Horsepower **Thomas Flyer**

Every stock Thomas car guaranteed to show sixty miles an hour before leaving the factory



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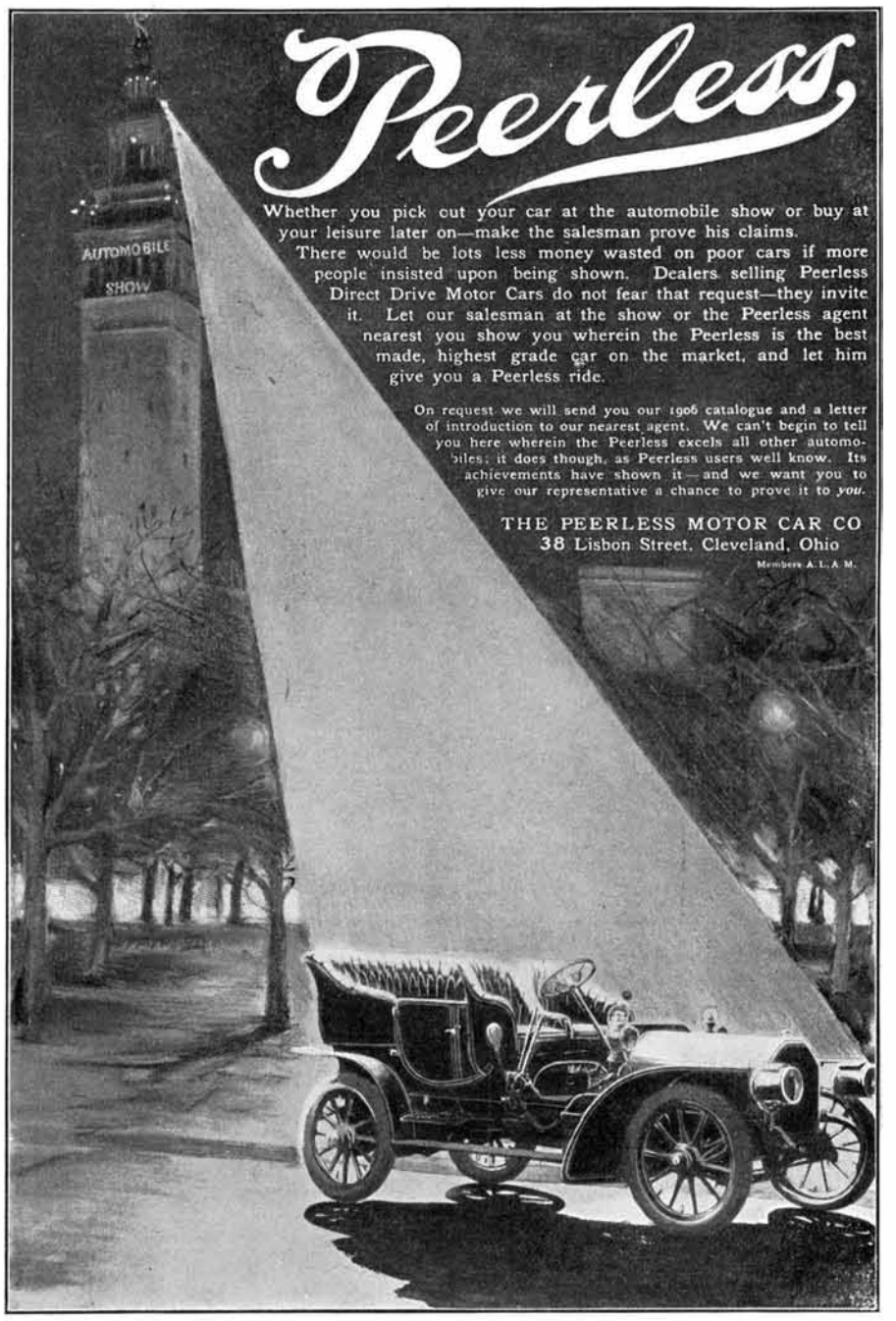

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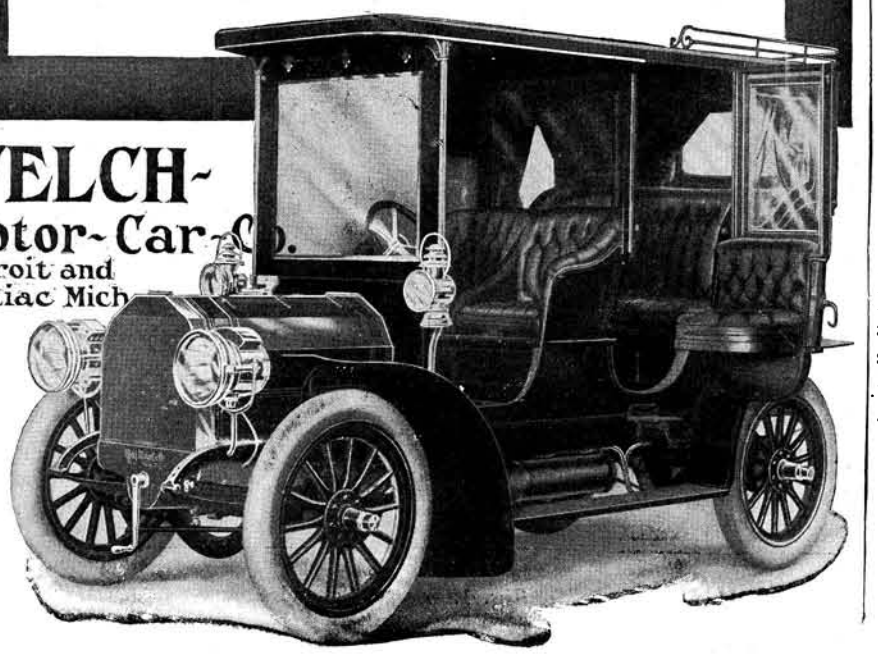
Welch Motor Car Co., Pontiac, Mich.



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POPE-HARTFORD MODEL F

is the result of our 28 years of experience in making and marketing mechanical vehicles and is the latest product of our famous Hartford factories. MOTOR: consists of 4-cylinder, vertical, water-cooled engine with cylinders cast in pairs; all gears encased; brake test 28-30 H. P. TRANSMISSION: sliding gear, 3 speeds forward and reverse. CARBURETOR: specially designed, insuring economy in fuel consumption and maximum power. CONTROL: throttle and ignition levers on single sector that does not revolve with wheel. DRIVE: bevel gear through propeller shaft to the rear axle. TONNEAU: non-removable, dust-proof, double side entrance. DESIGN: artistic in conception and execution.

While great attention has been given the essentials of construction it will be found that no detail has been overlooked. Everything that will contribute to the user's comfort and convenience has been embodied in this up-to-date car. (Extension top, $125 extra.) **Price, $2,500**

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is our 2-cylinder, opposed, 18 H. P., touring car. The engine is under the hood and all parts are accessible for inspection and repair. This is our dependable 2-cylinder machine of last year with such minor changes as have been suggested by a season's use. **Price, $1,600**

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ELECTRICITY IN HOSPITALS.

BY EMILE GUARINI.

Among the manifold purposes for which electricity is capable of being employed, its applications to therapeutics are the most curious, and a number of them are doubtless known to our readers. However this may be, we think it will prove none the less interesting to describe the electric apparatus which hospitals now have at their disposal.

The description that we propose to give is that of the apparatus which has been furnished quite recently to a hospital of London by Messrs. Lemmon & Co., of that city.

Among the principal of such apparatus we may mention those employed for the treatment of neurasthenia, rheumatism, anæmia, and pulmonary tuberculosis; a Lortet-Genoud lamp, a Finsen-Reyn lamp, an improved Finsen apparatus, a Roentgen apparatus, a Wimshurst machine, etc. The various instruments are placed in the upper-story rooms of one of the buildings. They are supplied by two groups of generators of electricity, that is to say, by two groups each consisting of a steam motor that actuates an electric generator.

These generators give a continuous current and send it to a distributing board provided with commutators, etc., in order to permit of distributing the current among the different experimental rooms.

For the treatment of arthritis, rheumatism, anæmia, and neurasthenia use has been successfully made of high-tension currents, which are also efficaciously employed for pulmonary tuberculosis in certain stages. These currents are produced by means of an induction coil, with a special mercury interrupter. This latter is actuated by a small motor that receives a continuous current from the line wire.

A continuous current is likewise sent through the intermedium of the interrupter to the primary of the coil, which thus receives very short emissions that succeed one another very rapidly, and, through induction, produce alternating currents in the secondary of the coil. The rapidity of the oscillations is increased by connecting, as in wireless telegraphy, the electrodes between which the sparks jump with the armatures of a battery of Leyden jars. The tension thus obtained is enormous and the discharges are very strong. Nevertheless they are applied to the subject to be treated, without any danger, either in the form of general or partial electrification.

The French Lortet-Genoud lamp, which the hospital has more or less modified, is applied to the treatment of lupus, that repugnant disease of which electricity has cured so many persons, and also to the treatment of rodent ulcer. We have all probably had an opportunity of witnessing some of the ravages of these two cutaneous affections. Diseases of this kind, those of the skin, are extremely painful, and those afflicted with them sometimes present a horrible sight. In this domain alone electricity has already earned our gratitude, since, for such affections, it furnishes one of the best remedies hitherto discovered.

The Lortet-Genoud apparatus (Fig. 1) consists of an arc lamp mounted upon a heavy standard, and the rays of which are projected by means of a double screen provided with two central lenses of rock crystal upon the affected part of the patient.

Between the walls of the lens support circulates the cold water designed, as in the types to be mentioned further along, to protect the lenses and absorb the calorific rays. The pencil produced by the lamp consists, in fact, of calorific, luminous, and chemical rays, and the object to be attained is to disperse those that would have only an injurious effect, and allow of the passage of the chemical ones, which alone are capable of acting efficaciously.

The Finsen apparatus, of which the Finsen-Reyn is only a simplified modification, is likewise employed for the treatment of lupus. It is therefore designed to permit of concentrating a pencil of chemical rays, that is to say, of ultra violet ones, upon the affected part of the patient, who lies upon a special couch.

In the simultaneous treatment of several persons, there is employed an improved model which is especially characterized by a better utilization of the luminous intensity of the lamp, the consumption of which is notably reduced as compared with that of the former types. It consists (Fig. 2) in principle, of a

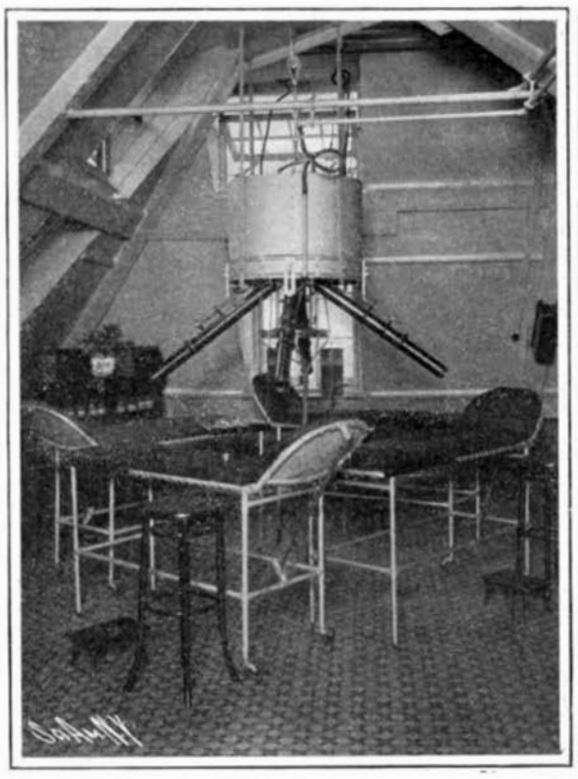

Fig. 2.—Finsen Apparatus.

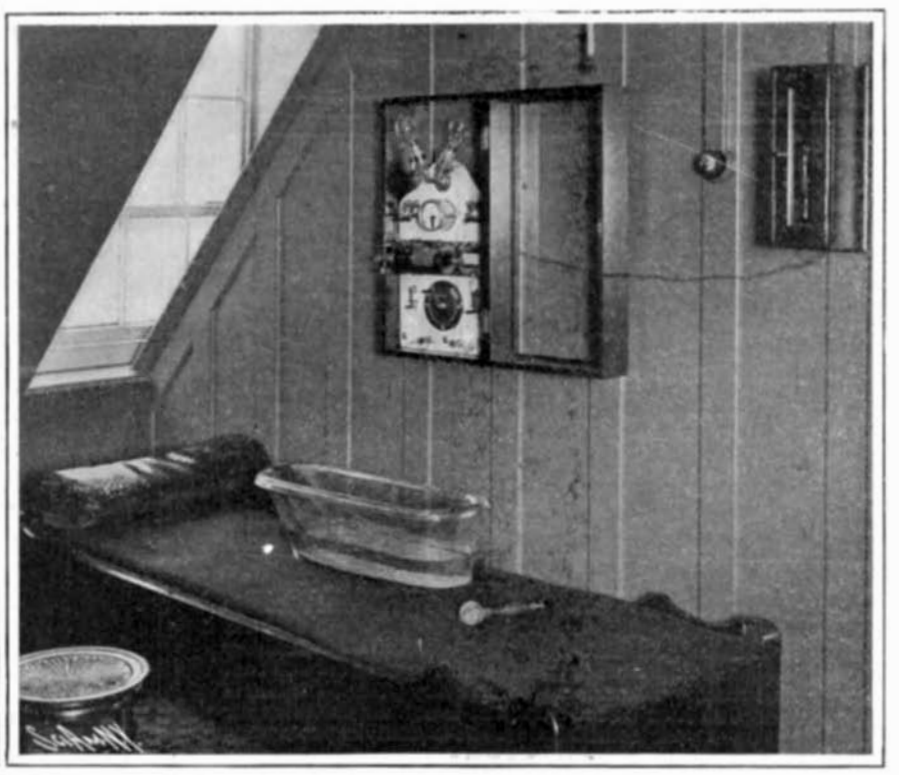

Fig. 3.—Apparatus for Galvanic, Faradic, and Electrolytic Treatment.

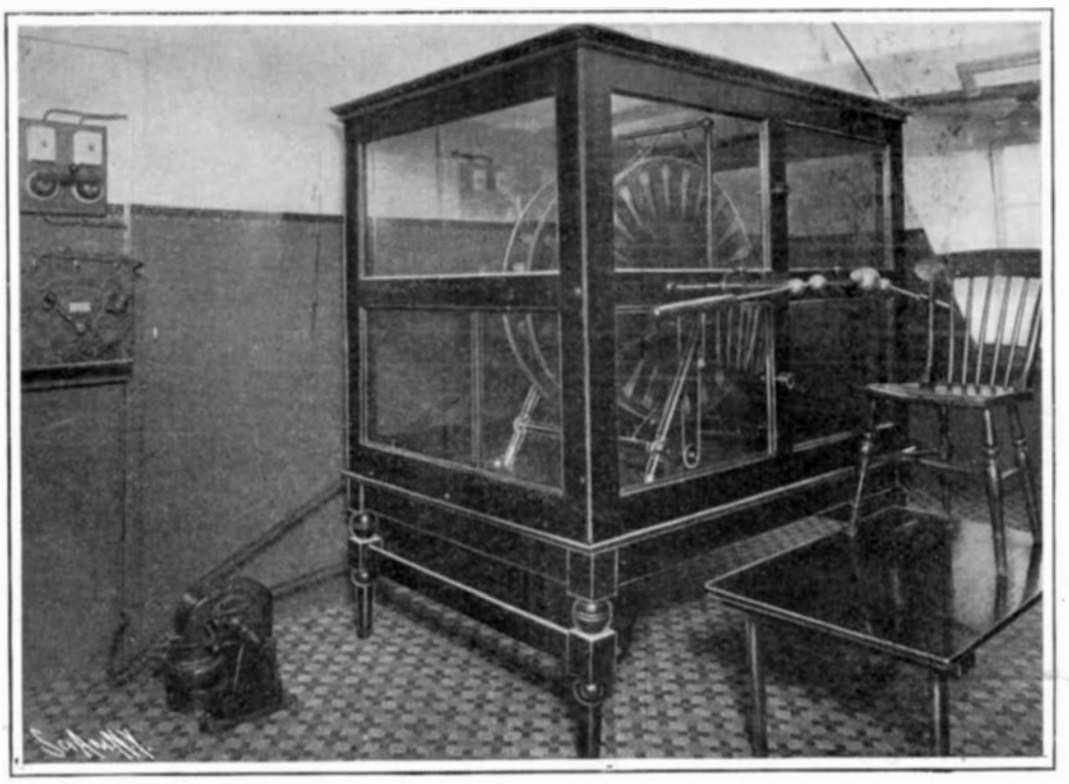

Fig. 5.—A Wimshurst Machine.

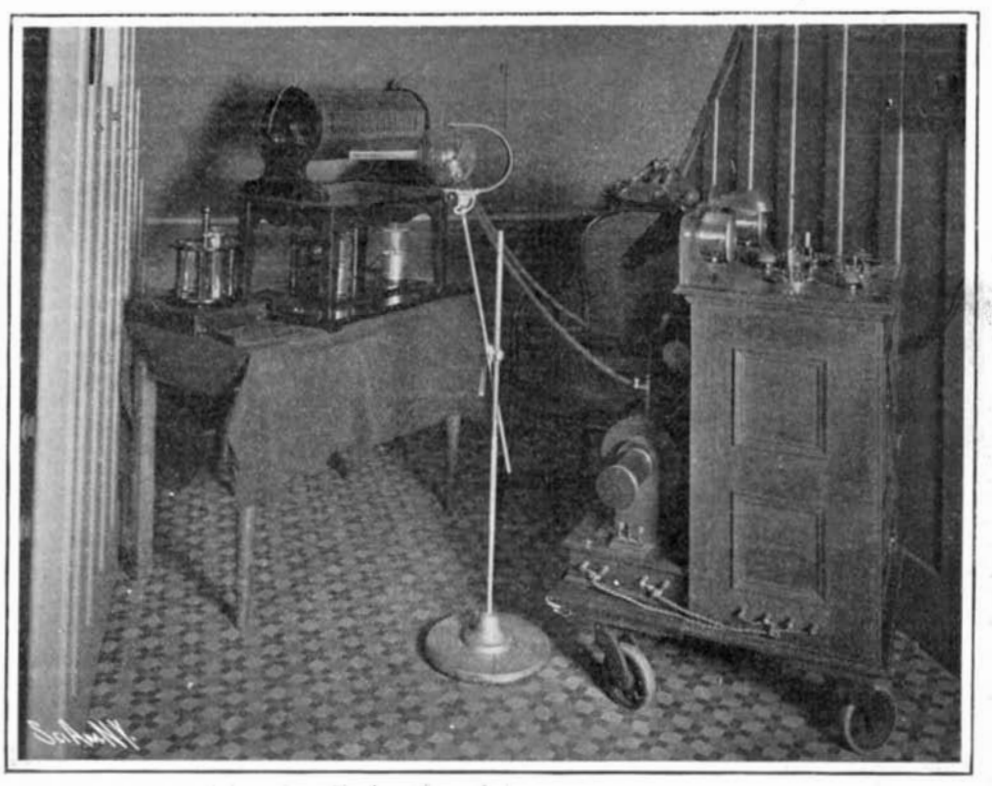

Fig. 4.—Roentgen Apparatus for Hospital Use.

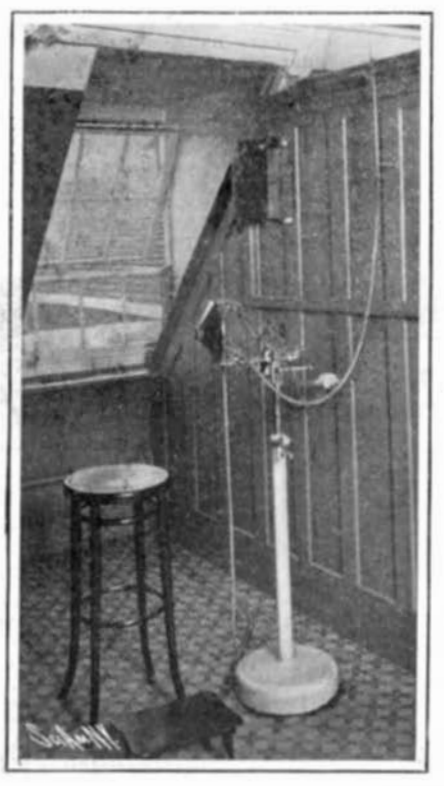

Fig. 1.—Lortet-Genoud Lamp.

At the Madison Square Garden Automobile Show the

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will center public interest in the Palace Touring Car and the Two-Cycle. Both of these cars emphasize the wonderful development of automobile construction in America. In style they set a swift pace for European manufacturers, and in performance they leave nothing to be desired in the way of speed, reserve power, easy riding qualities and general all-round completeness. Careful attention to the minutest detail is apparent in every line from the perfected motor to the adjustable lamp brackets.

If you, as a Possible Buyer of an Automobile (the Probable Buyer of an Oldsmobile after you have investigated) are too busy just at this time to let us give you a demonstration of our 1906 models, you can make a note, mental or otherwise, of the points which mark the strong individuality of these cars —the superior quality and big value they represent on your money investment.

In general appearance the Palace Touring Car, Model S and The Two-Cycle, Model L are very similar, both conforming in design to the most approved European practice. The general lines of both cars are the same. Both have all the regulation outfit, sliding gear transmission, pressed steel frame, bevel gear drive, material of the best—everything that anyone has or wants to have and a number of features all our own.

The gasoline "motor"—the *life center* of the automobile—is merely a gasoline engine. We have built gasoline engines for 25 years, and we know this end of the business—know what *not* to build as well as what to build. The result of this experience is found in the motor equipment of every Oldsmobile.

The Four-Cylinder Motor of Model S is compact and free from complications; it is vertical, water-cooled, located under hood, and perfectly balanced. The bore is 4¼-inch with 4¾-inch stroke, and the actual horse power is from 26 to 28. The weight of the car is 2,200 pounds. Wheel base 106 inches. Price $2,250, with complete horn and lamp equipment.

The Two-Cycle Motor is likewise vertical, water-cooled and located under hood. Bore 5 inches, stroke 5 inches. THERE ARE ONLY THREE WORKING PARTS IN THE MOTOR ITSELF. If you don't know anything about gears, valves, guides and a few other things, you don't have to learn, because they are not there in The Two-Cycle. It is a 24 H. P. team without a harness. It's the only new thing in the last five years—a trial will convince you. Price $1,250, with complete horn and lamp equipment.

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metallic cylinder suspended from a strong support and inclosing a lamp of great illuminating power. To this cylinder are secured telescopes, as well as tubes for the circulation of water for cooling the telescopes and compressors. These telescopes are provided with rock crystal lenses. Between the two side ones there is a space filled with distilled water for the purpose of protecting the lenses against a high temperature and of eliminating the calorific rays. The last of these are absorbed at the other end by a column of distilled water about twelve inches in length comprised between the two lenses. The compressors consist of two rock crystal lenses between which water constantly circulates. They are applied closely to the skin and finally exclude every trace of all but the chemical rays.

Another operating room contains apparatus (Fig. 3) for experiments in galvanism, Faradization, and electrolysis. Here, too, are treated rheumatism and paralysis, and more particularly the affection known as writer's cramp.

The apparatus of this laboratory are connected with a tablet of polished marble which carries different measuring, regulating, and commutating instruments. These latter are principally a sensitive galvanometer of precision for measuring intensities; a reversing commutator for reversing the direction of the current; and a rheostat, otherwise called a regulatable resistance, of 10,000 ohms divided into 56 degrees, that is to say, permitting of passing from 0 to 10,000 ohms through 56 graduated values, and of thus obtaining a very precise regulation of the current, etc.

A second group of very similar apparatus is placed in another room.

Roentgen rays are rendering valuable services in therapeutics, and the use of them in hospitals is now quite general. These rays, with whose strange powers every one is familiar, are, as is well known, obtained by producing electric discharges of great frequency in bulbs of highly rarefied air. Such discharges are produced by an induction coil of which the arrangement presents certain analogies with that which we have briefly referred to above in connection with high-tension currents. The most characteristic part (Fig. 4) is the bulb, which is mounted upon a heavy standard surrounded by a transparent screen in the form of a globe, which intercepts the X-rays and protects the operator and patient against their dangerous effects. They are capable of reaching only the part of the body affected, since they are conducted by a tube of appropriate form fixed in an aperture with which the globe is provided. Such an arrangement presents different advantages.

Let us have a few words to say also of the Wimshurst machine (Fig. 5), one of the most remarkable of friction apparatus, and which is described in all works on electrostatics. This apparatus is employed with success in America for the treatment, under the name of Franklinization, of certain nervous affections, and especially of rheumatism. The use of it is spreading likewise in England.

Finally, an apparatus which is no less interesting is the one that serves for massage and advantageously replaces massage by hand. This apparatus, of which the use is rapidly spreading, consists of an electric motor to the shaft of which is secured a large flexible cable, to the end of which is fastened a ball to which is communicated a vibratory motion of which the amplitude depends upon the regulation given it by means of a special arrangement that can be made to act during the operation. In this massage ball there are three screw holes into which may be introduced pieces of appropriate form for the local massage of small muscles in certain parts of the body. The motor employed for this is a special one, and is at the same time a transformer which converts the continuous current furnished it by the line wire into an alternating one—a form of current that changes direction periodically and regularly with more or less rapidity.

Another purpose for which the current is used is for the small electric lamps employed for the treatment of laryngitis and analogous affections. The applications of electric energy to medicine will doubtless not stop here. Surgery will also find in the electric current a sure and valuable aid.

M. Leduc has already made known the anæsthetic effect of electric currents of high frequency, and has demonstrated that, under their influence, any animal falling upon the side sleeps a deep sleep that is interrupted neither by the prick of a needle or a burn by a hot iron.

It is doubtless known that MM. Didsbury and Regnier have constructed upon this principle an apparatus designed for the painless extraction of teeth. It has recently been found that the violet rays have the same effect.

The rays of an incandescent lamp, with a bulb of proper color surrounded by an appropriate shade, directed upon the eyes of a patient by means of a reflector of nickel-plated metal, produce at the end of two or three minutes an anæsthesia that suffices for the performance of unimportant operations.

These are facts of great interest that are multiplying every day and are constantly increasing the number of our methods of combating disease.

A BICYCLE GENERATING STATION USED BY THE GERMAN ARMY'S WIRELESS TELEGRAPH CORPS IN THE SOUTH AFRICAN CAMPAIGN.

A NEW TYPE OF PORTABLE WIRELESS TELEGRAPH STATION.

BY DR. ALFRED GRADENWITZ.

A very convenient type of portable wireless telegraph station was described by the author some time ago in these pages. The Wireless Telegraph Company, of Berlin, who were the constructors of these stations, have recently designed another type of such lightness as to require no carts in their transportation.

Chiefly remarkable in this portable outfit are the means of generating energy. A bicycle dynamo is used. The constructive principle of the latter is simple. A small direct-current dynamo of about 100 watts output is fitted to a bicycle frame. The rider, if he may be so called, keeps the machine going by smart pedaling. From the sprocket of the bicycle frame the movement is transmitted to the dynamo by means of a belt, driving a specially-designed aluminium disk, the ratio of transmission being so designed as to have the dynamo produce sparks of 4 millimeters length in the induction coil, in normal operation. As the dynamo is located in front of the operator, the latter is in a position at any moment to supervise its uniform activity. The weight of the dynamo outfit is 30 kilogrammes (66 pounds). In the place of the device above described, a stationary motor cycle with a dynamo fitted on can be used. Apart from the dynamo a portable accumulator battery can be made use of to supply the energy required. The battery includes eight cells (16 volts), possessing a capacity of about 30 ampere-hours with a five hours' discharge. The admissible limit of discharging intensity is about 25 per cent greater than the energy necessary in normal working order. The cells are inclosed in an ebonite box, which is in turn divided into two compartments of 30 kilogrammes (66 pounds) weight each.

A CLEVER MECHANICAL AND ELECTRICAL AUTOMATON.

An interesting, novel, and pseudo-scientific attraction has recently been entertaining London audiences at the Hippodrome variety theater. This is a cleverly-constructed figure which apparently walks and writes automatically. It is called "Enigmarelle," and is seemingly a mechanical and electrical combination. The figure stands exactly six feet in height, weighs 198 pounds, and is composed of 365 distinct and separate parts. As to composition, the feet are of iron, the lower limbs of steel and wood, while the arms are of steel and copper. The body is an insulated steel wire frame, cased with fiber and rawhide, while the head is of wax. The figure contains seven motors, three of which are spring and four electric. They are distributed in different parts of the body and are said to operate the various members assigned to them in the following manner:

The two most powerful motors, which are of special design, propel the lower limbs, and cause the automaton to walk. A third operates the arms, a fourth the balance weights. Of the spring motors, the first controls the head, the second acts as an auxiliary to the electric motors in the movement of the arms, while the third operates the wire bobbins, which wind and unwind with the ever-changing position of the weights.

There are fourteen dry storage battery cells of small capacity. They are of special design and constructed to serve a double purpose—not only to furnish power to the motors, but also to maintain the equilibrium of the figure. A little below where the hip joint would be on the left of the figure, is the terminal of a semi-circular vulcanite track, which passes up and over the upper part of the chest, de-

(*Continued on page* 57.)

Automaton Writing. Chest Mechanism Exposed.

Introducing "Enigmarelle."

The Automaton Riding a Bicycle.

A CLEVER MECHANICAL AND ELECTRICAL AUTOMATON.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

EGG-CASE-CARRYING ATTACHMENT FOR VEHICLES.—R. N. Story, Clay Center, Kan. The aim of this improvement is to provide a novel simple case-holder that may be readily and securely mounted and detachably secured upon the rear portion of a buggy or a like vehicle, and thus afford reliable means for conveniently placing and holding an egg-case on the vehicle for transportation of the filled case to a market for the eggs.

BEEHIVE.—J. F. Stills, School, Ill. The aim of this improvement is to produce a moth-deceiver attachment which acts for such purpose and also serves as a rest or support for the frames, and also to produce a separator-board whereby the size of the colony may be accommodated and regulated, and also to produce a beehive the general make-up of which will facilitate the handling of bees.

FENCE-POST.—S. H. Summerscales, Winnipeg, Canada. This invention relates to a supporting device which although capable of general use is especially adapted for use as a fence-post. Among the other uses to which it may be put are the supporting of walls, floors, ceilings, roof materials, and railroad-rails. The principal objects are to provide a support of non-inflammable material which is not subject to decay on account of the action of the elements and which will avoid many well-known difficulties.

BROODER-COOP.—T. O'Brien, Branford, Conn. The coop is arranged to insure proper ventilation and to provide a clean and healthy brooding-compartment for a hen and a separate scratching-compartment for chicks, to allow the latter to readily pass from the brooding to the scratching-compartment, and vice versa, and to allow the chicks to scratch and feed in the scratching-compartment in all kinds of weather without annoyance from the sitting hen or chickens from other coops, and to protect the chicks from attack at night or day from enemies of the chicks.

HARVESTING-MACHINE.—W. Livtschak, Wilna, Russia. In this patent the invention relates to improvements in harvesting-machines whereby the construction of the machine is simplified and a new combination of known devices is produced, so that the usefulness of the machine is considerably increased. The machine is suitable for all kinds of crops, also for grass.

Of General Interest.

WALL-COVERING.—T. Cleary, Schuylerville, N. Y. In this instance the object of the invention is the provision of a new and improved wall-covering which has a highly ornamental plush effect. The invention consists of a new article of manufacture—namely, a wall-covering consisting of a fabric body and coating thereon in plush effect.

HOISTING DEVICE.—P. A. Gould and G. R. Watson, Saranac Lake, N. Y. This device is for facilitating the raising of heavy weights. It is especially useful in lifting transformers to attach them to electric-light poles. One object is to produce a device which may be readily set up temporarily upon an electric light pole for the purpose suggested. A further object is to so construct the device that it readily adapts itself to the construction work at the top of an electric-light pole, enabling the device to be readily applied to poles of different kinds or having cross-arms differently arranged.

COMBINATION-TOOL.—E. Hogan, Portland, Ore. This tool is capable of many uses. It may be used as a level to level in all directions without moving the tool. Difference between low and high points in degrees may also be determined. It may be used as a plumb to plumb at any angle without moving the same and to determine the amount of angular deviation of objects. It levels and plumbs one way and any angle desired at right angles at the same time without moving the tool.

ARCH-FILE.—R. H. Johnson, Jersey City, N. J. This improvement refers to a file for securing loose leaves. The principal object is to provide means whereby the distance from each other of the arches or other holding devices for the file can be varied at will to accommodate different punchings in the sheets to be held. Means provide for easily detaching the arches from the main body of the holder and readily slipping the articles to be held onto them.

HEAD-REST.—F. M. Kandle, Atlantic City, N. J. In the present invention the improvement is in head-rests intended especially for barbers' chairs, being in the nature of a flexible cover for the ordinary head-rest provided with means whereby it may be secured in place upon the head-rest and with openings through which a sheet of paper forming a sanitary cover may be passed and with means for supporting a package of paper.

CONDENSER.—F. Kaiser, New Orleans, La. This improvement is in surface condensers intended especially for condensing and cooling ammonia-gas, but may be used for condensing steam or for use in any other suitable heat-exchanging apparatus. It relates particularly to the sets of condensing-tubes and the construction whereby they are secured within the shell, so the tubes can be readily assembled, can be conveniently inserted or removed from the shell, and can be securely packed in such shell to prevent any leakage, and will compensate, in a measure, for variation in expansion and contraction between such tubes and the shell of the condenser.

ATTACHMENT FOR FRUIT CANS AND JARS.—C. M. Leffingwell, Littlefalls, Minn. Briefly stated the improved attachment invented by Mr. Leffingwell holds fruit submerged below the surface of the juice and also serves as a mold-extractor in case mold forms, since it may be readily lifted out of the jar with the mold adhering thereto.

CHEMICAL CHART.—C. D. Poore, Minneapolis, Minn. Mr. Poore's invention relates to charts, and more particularly to a chart specially arranged for work in chemistry, the arrangement being such as to assist the investigator in determining the composition of certain compounds in formulating appropriate chemical terminology for compounds of known composition and in studying chemical reactions.

Machines and Mechanical Devices.

SHARPENING-MACHINE FOR DRILL-BITS.—T. H. Proske, Denver, Col. The invention relates to sharpening-machines for drill-bits, such as shown and described in the Letters Patent of the United States, formerly granted to Mr. Proske. The object of the present invention is to provide a machine arranged to permit of sharpening various sizes of drills in a single pair of dies by the use of different-sized dollies, the sharpened drills being accurate and regular both in gage and form to insure drilling of straight holes without danger of the drill sticking in the hole.

SOAP-MACHINE.—N. G. Knight, Crestline, Ohio. In this case the improvement refers to machines for effecting saponification, and has for its principal objects the provision of a convenient arrangement of gearing for driving the rotatable elements and means for introducing material during the operation of the machine.

KEY-SEATING DEVICE.—I. W. Jones, Birmingham, Ala. Chief objects of this invention are to so construct a cutter-holder as to permit a straight and readily detachable and replaceable cutter to be employed, to permit the holder to be made practically solid from the cutter to the end, to secure a solid and strong abutment for cutter to bear against while operating, to place the feeding mechanism for cutter above the cutting edge, to provide the feeding-pin with means for increasing tension of relieving action at the time when tension is most needed, to avoid putting strain on the feeding mechanism while cutter is operating, and to make the bar strong and protect all parts from chips.

BELT-GUIDE.—M. E. DeGree and D. C. McAlister, Flaxton, N. D. The principal objects of the invention are to provide means for guiding a belt to or from a pulley, even when the two pulleys over which the belt passes are not of alinement, to provide means for preventing the belt from being thrown from the pulleys under any circumstances, and to guard against any cutting action upon the belt or any unnecessary wear thereof.

Medical Appliances.

RECTUM-SUPPORTER. — E. H. Higbee, Roodhouse, Ill. The purpose of the invention is to provide a practical, light, and simple appliance especially adapted for the relief and cure of prolapsus of the rectum and hemorrhoids or piles and to so construct the appliance that it may be worn with comfort and may be partially removed in an expeditious and convenient manner when occasion demands.

SURGICAL APPLIANCE.—H. T. Foote, New Rochelle, N. Y. The object of this inventor is to provide a device for preventing nocturnal emissions of the male human being, the device being simple and durable in construction, designed for convenient attachment and removal, and arranged to prevent pressure on the dorsal veins of parts, and allowing the wearer to urinate while the device is in position.

Prime Movers and Their Accessories.

ROTARY ENGINE.—G. L. Loper, Norcatur, Kan. In this patent the invention consists in the novel construction and arrangement of parts acting upon the general principle in relation to rotary engines of that class in which the outside casing revolves and the steam is admitted to the same through a central core having steam-ports.

Pertaining to Recreation.

BOW-FACING OAR.—G. M. Kerry, Boyne, Mich. In operation the gunwale-plate is clamped to the gunwale and the thole-pin is passed through the opening in the bottom of the groove and into the gunwale, the body portion of the yoke engaging the groove to prevent rotation of plates. Moving the handle-sections in the usual manner will produce a reverse movement of the blades. Dipping of the blade is permitted by hinging of the plates to the yoke. To convert bow-facing into stern-facing oars, it is only necessary to remove the gunwale-plate and insert cotter-pins.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(9868) J. T. asks: I would like to ask you if you can give me a formula for sensitizing porcelain with a solution and then electroplate it with copper? A. An article of porcelain which is to be plated with copper may first be coated with a tough varnish such as copal, and when the varnish is dry it should be thoroughly covered with plumbago as a basis for the copper plating. Sometimes a flashing of gold is burnt on and the copper is deposited upon the gold. This makes a firmer deposit than is possible with varnish. For details of all such processes see Watt and Philip's "Electroplating."

(9869) W. A. M. writes: Some time ago you published certain notes showing how to calculate the dates on which Easter will fall, which were very interesting, but obviously incomplete, it being necessary to consult a calendar to find the day of the week corresponding with the date arrived at by the calculation. If you have a calendar for the year, there is no need for your rule, it is easier to turn up March and April and find it all worked out for you. If you have not the said almanac, how do you proceed? The following is my way of finding the day of the week for any date, or conversely the date of any day in any year. I use the following motto, "Queen Woman Wins by Subtlety," because the vowels *a, e, i, o, u, w, y* are incorporated in the order to show the date of the first Thursday in each month of the year 1905; thus, the first vowel used in the motto is *u*, representing the first month, the second vowel *e* stands for the second month, and so on, until the twelfth vowel *y* in the motto stands for the twelfth month. Next the *u* representing the first month is the fifth in the order *a, e, i, o, u, w, y*, and the first Thursday of the first month of 1905 was the fifth. The fourth vowel is *w* for the fourth month; the first Thursday in fourth month was on the 6th, *w* being the sixth in the order *a, e, i*, etc. The ninth and twelfth months are each represented by the ninth and twelfth vowels *y*, which is the seventh in the order *a, e i, o*, etc., showing that the first Thursdays in the ninth and twelfth months fall on the 7th. The motto easily lends itself to division; thus the word "Queen" is the first three months, "Woman" the second three months, "wins by" the third quarter, and "subtlety" the last three months of the year. Example 1. What day of the week will be December 28, 1905? The vowel for the twelfth month is *y*, the seventh in the order *a, e, i*, etc., therefore the 7th, 14th, 21st, and 28th December are all Thursdays. Ex. 2. What day of the week will be September 4, 1905? September is the ninth month. The ninth vowel is *y*, therefore as Thursday is the 7th, Monday will be 4th. Ex. 3. What will be the date of the third Monday in June, 1905? June is the sixth month, the sixth vowel is *a*, showing that Thursday was the first (*a* being the first in the order *a, e, i*, etc.) and Monday the fifth. The third Monday in June, 1905, was the 19th. It must be remembered that the dates given in the motto are Thursdays for 1905. They will be Fridays in 1906, and Saturdays in 1907, in 1908 they will be Sundays, until February 28, after which they will be Mondays, and so on forever, constituting a perpetual calendar. Ex. 4. What day of the week was March 21, 1818 (the day on which your rule for finding the date of Easter shows to be the date of full moon in that year)? Rule. To the difference between the years, add the number of leap years that have intervened, divide by seven, and count back as many days as the number remaining. This will give the day for the year, and proceed as above. Thus, 1818 from 1905 leaves 87, add 21 leap years, making 108, dividing by 7, leaves three of a remainder. Three days back from Thursday (the day for 1905) gives Monday as the day for 1818, that is, the dates given by the motto were Mondays in that year. Now March is the third month, and the third vowel in the motto is *e*, the second in the order *a, e, i*, etc. The first Monday in March, 1818, was the second day of the month, and the 9th, 16th, and 23d were also Mondays, and the 21st was Saturday, next day Sunday—the earliest possible date for Easter. To find the day for any future year, proceed exactly as in Ex. 4, but count forward the number of days shown by the remainder. A. This ingenious scheme is adapted perfectly to all years in which January 1 is Thursday; but for other years some calculation is required. It does not fix Easter day. As we have said before, Easter cannot be fixed by persons not familiar with the motions of the moon. The best way to find Easter for any year is to refer to an Episcopal Prayer Book, which gives the date for several centuries.

NEW BOOKS, ETC.

Oil Colors and Printers' Inks. By Louis Edgar Andés. New York: D. Van Nostrand Company, 1904. 12mo.; pp. 212. Price, $2.50.

This is a practical handbook treating of linseed oil, boiled oil, paints, artists' colors, lampblack and printers' inks, black and colored. In addition to information with regard to linseed oil, the chief raw material, its purification, and bleaching for making varnishes and pigments, the book contains short dissertations on the theory of drying oil, of the pigments that can be used with it, and the chief adulterations. A special chapter is devoted to lampblack. Attention is given to the manufacture of pigments, their mixing and grinding, and to the manufacture of printers' varnishes and colored inks, including all the latest patented products. The section dealing with artists' colors is quite new, and will not be found in any other work of this kind. The author has been engaged for a number of years in the manufacture of varnishes, pigments, and colored printing inks. Fifty-six illustrations accompany the text.

Civil Engineering. A Textbook for a Short Course. By Lieut.-Col. G. J. Fiebeger, U.S.A., New York: John Wiley & Sons, 1905. 8vo.; pp. 573. Price, $5.

This textbook is designed primarily for the cadets of the United States Military Academy, who have been fitted for a profession in which the principles of civil engineering are of daily application. In time of peace the officer in an isolated station finds himself called upon to act as engineer and constructor of buildings, roads, and bridges. If not the engineer charged with the construction of water works and sewerage systems, he finds himself charged with their maintenance and repair. In time of war a knowledge of the construction of buildings and bridges enables him to effect their destruction without loss of time or the aid of skilled workmen. The entire subject of military engineering, including fortification, sapping, mining, pontoneering, etc., is simply the application of principles of civil engineering and tactics to military problems. For the above reasons the faculty of the Military Academy has always provided a short course in civil engineering, and it is for the use of these students that this book was primarily written. The author is Professor of Engineering at the United States Military Academy, and he has produced a most valuable textbook.

An Introduction to the Design of Beams, Girders, and Columns, in Machines and Structures. With examples in graphic statistics. By William H. Atherton, M.Sc. London: Charles Griffin & Co. Philadelphia: J. B. Lippincott Company, 1905. 12mo.; pp. 236. Price, $2.

The design of beams in relation to strength and stiffness and convenience of construction is a study that appeals to all classes of engineers and architects, for in all machines and structures beams appear in one form or another, and little progress can be made in scientific designing without a proper understanding of the principles or fundamental facts underlying their construction. Hence great prominence is rightly given to this subject in a course of applied mechanics, machine and building construction, and naval architecture. As denoted by its title, this book is extremely introductory in its aim and scope. A careful examination of this book shows that the author has produced a conscientious work, which cannot but prove of value to the student.

Earth and Rock Excavation. By Charles Prelini, C.E. New York: D. Van Nostrand Company, 1905. 8vo.; pp. 357. Price, $3.

The author justly states in his preface that there is hardly a class of engineering construction into which the excavation of earth or rock does not enter to some extent, and, in many engineering works, excavation is by far the largest item of labor and expense. Despite these facts English engineering literature is almost barren of books which treat of earth and rock excavation in a concise and comprehensive manner, having regard both for the planning and computation of such work, and for the methods and machines by which it is accomplished. The present book is an attempt to supply this deficiency, and has been written with the following objects chiefly in view: First, to concentrate in a small volume descriptions of the various operations which are required for planning and executing any work of excavation in earth or rock; second, to classify and describe clearly the various implements and machines used for excavating and hauling away the material. So far as the author knows, there is no publication in the English language which gives these facts. An examination of the books shows that the practical side is in no case neglected for the theoretical. It is a good addition to the literature of engineering.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7660.—For makers of oil burner capable of use in a wood heater.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7661.—Wanted, a manufacturer to make pressed paper tubing, particularly strong and durable, 140 millimeters inward clear diameter and corresponding thickness, to bear inward pressure of nearly 200 atmospheres; tubes to be about 120 centimeters long.

Drying Machinery and Presses. Biles, Louisville, Ky.

Inquiry No. 7662.—For makers of portable table to be attached to any chair.

WANTED.—Purchaser for Monazite, Molybdenite and Wolfram. Apply Monasite, Box 773, New York.

Inquiry No. 7663.—For manufacturers of powder in bulk, made from silica rock.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7664.—For manufacturers of machinery for making, nailing, etc., wooden boxes, as large as 29 x 19.5 x 11.7 inches.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7665.—For manufacturers of pins.

WANTED.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7666.—Wanted, makers of small water tube boilers for marine use.

I have for sale the U. S. and all foreign rights of new patent Improvements in Water Tube Types of Boilers. Great economizer. J. M. Colman, Everett, Wash.

Inquiry No. 7667.—For manufacturers of dental goods, such as teeth and filling materials.

Young American permanently residing in Lima, Peru, S. America, wishes to hear from firms interested to be represented there. Further information. F. Thorn, Milford, Mass., P. O. Box 18.

Inquiry No. 7668.—For parties engaged in erecting fire escapes.

FOR SALE — PATENTS. — Life saver; great money maker; it is a great invention; something never introduced before; can be seen; only buyers. Apply by letter, Nicholson, 651 3d Avenue.

Inquiry No. 7669.—Wanted, addresses of makers of two-cycle gas engines.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools and wood fibre products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 7670.—For dealers in name plates, trunk checks, old badges, etc.

PATENTS.—Wanted, the service of a patent expert and experienced specification writer. No one need apply who has not had a thorough education along technical lines, and who has not had experience in patent practice. Munn & Co., 361 Broadway, New York.

Inquiry No. 7671.—For manufacturers of producer gas machines.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 7672.—For manufacturers of astronomical telescopes.

Inquiry No. 7673.—Wanted, manufacturers of railroad iron.

Inquiry No. 7674.—Wanted, makers of elastic bed mattresses and pillows.

Inquiry No. 7675.—Wanted, name and address of the makers of the Electric Shoe-shining Machine.

Inquiry No. 7676.—For makers of wire artists' supplies, such as jewelry and beads.

Inquiry No. 7677.—Wanted, a 1,000-foot gas holder.

Inquiry No. 7678.—Wanted, hand knitting machines for cheap cotton stockings.

Inquiry No. 7679.—For makers of thermostats and heat regulators.

Inquiry No. 7680.—For manufacturers of molds for molding plaster.

Inquiry No. 7681.—For dealers in crude rubber.

Inquiry No. 7682.—Wanted, manufacturers of glass bottles.

Inquiry No. 7683.—For dealers in Canada or Brazil wax.

Inquiry No. 7684.—Wanted, makers of machines for weaving "K" woven wire fence.

Inquiry No. 7685.—Wanted, catalogues of the latest fire extinguishers by carbonic acid or other chemicals.

Inquiry No. 7686.—Wanted, makers of advertising clocks, about 6 feet high by 2 feet wide.

Inquiry No. 7687.—Wanted, a pump for drawing water out of a suck line for natural gas.

Inquiry No. 7688.—Wanted, machines for drying, cutting and evaporating fruits.

Inquiry No. 7689.—Wanted, makers of apparatus suitable for general metallurgical and heating purposes.

Inquiry No. 7690.—For makers of parts with which to construct a dynamo.

Inquiry No. 7691.—Wanted, recipes for making first-class rubber-stamp ink.

Inquiry No. 7692.—Wanted, recipes for making colored mill crayons.

Inquiry No. 7693.—Wanted, makers of hosiery machines, also of a machine by which 2 to 8 dozen Guernsey frocks can be made in 8 hours.

Inquiry No. 7694.—Wanted, a cement-making apparatus for mixing rubber cements.

Inquiry No. 7695.—Wanted, the name and address of the makers of the celebrated Chime Hall Clock movements, tubular chimes.

Inquiry No. 7696.—For makers of novelties or aluminum goods.

Inquiry No. 7697.—For makers of coal oil stove burners, also crude oil stove burners.

Inquiry No. 7698.—For manufacturers of induction coils.

Inquiry No. 7699.—Wanted, address of parties who bend sled runners.

Inquiry No. 7700.—For manufacturers of peppermint.

Inquiry No. 7701.—For manufacturers of nails, saws, wire, hinges; also cotton goods.

Inquiry No. 7702.—For manufacturers of ball-bearings.

THE MARMON AIR-COOLED TOURING CAR.

(*Continued from page 28.*)

necessary, but the large expanding-ring brakes in the rear wheels are usually ample. The rear axle has an aluminium gear case, whose two halves are cast upon two axle sleeves, thus making an integral piece of each. The wheels and differential revolve on Hyatt roller bearings. Floating interior half-axles drive the wheels through jaw clutches on the hubs. The thrust of the bevel pinion is taken up by a rolling contact of the pinion against the bevel gear—a very simple arrangement.

Aluminium is used wherever possible throughout the car. The body is constructed almost entirely of cast aluminium, as is also the dash and fenders. Vertical fenders from running board to body are one of the good features, as they keep down both dust and mud. The entire machine, with the exception of wheels and tires, is constructed in the large new addition the company has made to its plant for this purpose. The car is one of the best-built air-cooled machines on the market. That it can make fast time under all ordinary circumstances was demonstrated by its performance in the economy test held last November.

NEW FOUR-CYLINDER AIR-COOLED MOTOR,

(*Continued from page 29.*)

fit into notches in the shifter bars to locate them securely when the gears are completely in mesh. The bars are shifted by a single hand lever working in an H-shaped quadrant on the selective system. The selecter box is dustproof, and contains a simple device which positively locks, in their neutral position, all the shifter bars except the one in use.

This transmission is modeled after the latest Mercedes speed-change gear. The shafts run on the non-adjustable ball bearings (which are also used on the road wheels), and the differential countershaft across the rear of the transmission is used for transmitting power to the wheels by means of sprockets and chains. The outer ball bearings of the countershaft are exactly under the sprockets. The advantages claimed for the transmission are that the divided shaft with one part running on the other (which makes a bearing difficult to oil and subject to great wear) is entirely avoided, while the shafts are much shorter between bearings, and hence have no tendency to spring while the intermediate gears are in use.

Six years ago the Knox Company built their first machine, fitted with a single-cylinder air-cooled motor of 4 horse-power. This was the first slow-speed motor of large bore and stroke to be made commercially successful. It was superseded by still larger motors of the double-opposed, horizontal type, and this year a still larger vertical, four-cylinder motor has been placed on the market. The cylinders of this engine have a 4¾-inch bore by 5½-inch stroke. They are cast separately, and besides having reinforcing ribs near their base, they have about one-third fewer pins per square inch of cylinder surface, and the pins are about half the length of those that were used heretofore. Experiment has shown that the Knox cylinder is more efficient when a lesser radiating surface is used. As heretofore, everything is very substantial about the Knox car. The 1⅝-inch crankshaft is supported in five separate bearings attached to the upper half of the crankcase. These bearings are 3 and 4 inches long, and those of the hollow wrist pins are 2¼ inches long. The valves, which are located in the cylinder heads, are 2 inches in diameter and interchangeable. They are made of a special steel and nickel alloy. Each valve cage fits into a pocket, from which it may be removed without disturbing any of the connections, and simply by unscrewing one nut. The valves can, therefore, be ground outside of the engine. Separate camshafts operate the inlet and exhaust valves, by means of push rods and rocker levers. Special auxiliary coil springs are

attached to the latter. The gears are all inclosed and run in oil. The camshafts may be easily removed, and the crank bearings can be adjusted through the inspection covers in the crankcase. High-tension magneto ignition is employed, the magneto being gear-driven direct from one of the camshafts. A coil is used in connection with the magneto, and the distributor on the same directs the current to the spark plugs of the various cylinders. A metal-to-metal cone clutch running in oil is located in the flywheel of the engine.

THE OLDSMOBILE TWO-CYCLE AND FOUR-CYCLE TOURING CARS.

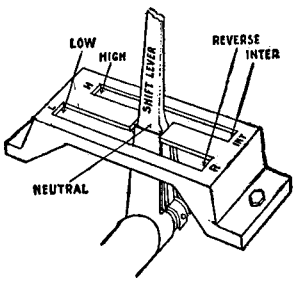
(*Continued from page 30.*)

is placed between the engine and the transmission in addition to the two protected universal joints in the propeller shaft. The motor and transmission are mounted upon a sub-frame, which is suitably braced by steel plates riveted to the main pressed-steel frame. All working parts of the machine may be removed without disturbing the alinement of the crank and transmission cases. The radiator also is mounted on the sub-frame, for the purpose of doing away with excessive vibration of this delicate member. The running board and mud guards are attached by means of tapered sockets, which makes them readily removable. This is a minor distinctive feature of the new Olds car. The four-cylinder, four-cycle motor of the larger touring car also has several distinct features. In the first place, the oiling system is very complete. The oil is pumped from an oil well in the base through passages in the crankcase of the motor to all the bearings of the same. The lower half of the crankcase contains a certain amount of oil, the splash from which is used to lubricate the cylinders. The level is maintained in the base by means of holes leading to the oil well below, any overflow passing immediately into this reservoir. A positively-driven oil pump operated from the camshaft (which is hollow and also has oil forced through it for the lubrication of its bearings) circulates the oil through the passages of the crankcase. A glass bull's eye in the front of the case shows the amount of oil present at all times. In the bottom view of the chassis the oil well is seen as a long cylinder running the length of the crankcase. The water pump is also ingeniously housed in the rear end of the crankcase, where it is driven by gears. The view of the motor shows the cylinders to be cast in pairs, with all valves located on one side and mechanically operated from a single camshaft. The contact box is at the rear end of the motor on the top of a vertical shaft, driven by bevel gears from the camshaft. Jump-spark ignition with separate coils and both storage and dry batteries is used. The clutch is of the ordinary cone type, but it is equipped with a spring device which allows the load to be picked up slowly and without any jerks. The clutch cone carries a large grease cup for the lubrication of the bearing that the clutch revolves upon when it is not engaged. The exhaust and the inlet pipes of the motor can readily be removed by taking off the clamping piece held by two nuts. The valves can be removed through holes in the valve chambers, and the valve stems and their bushings can also be taken out by undoing the clamps which hold the latter in place. The crankcase bearings are supported on the upper part of the motor base, and the whole bottom half of the crankcase can be removed when it is desired to adjust these bearings. The steering gear of this touring car is very well designed and has small grease cups on all important joints, so that the wear can be minimized. All the steering connections are easily adjusted. An irreversible worm steering gear is used. The four-cylinder car has a 4¼ x 4¾-inch motor, capable of developing 26 to 28 horse-power at 1,000 R. P. M. The machine weighs about 2,000 pounds, has 106-inch wheel base, and is capable of speeds of about 50 miles an hour. The lighter two-cycle car weighs only 1,700 pounds, which, with its 25-horse-power motor, should make it a very speedy and capable machine over all kinds of roads.

PEERLESS TOURING CAR.

(*Continued from page 31.*)

running in oil, and the object of the box being set at an angle instead of vertical is to keep the roller always submerged, which does away with trouble from arcing. The radiator is constructed of flat copper tubes connecting with the surrounding water tank, which is a solid casting. The gear-driven centrifugal pump, housed in the crankcase and running in oil, forces the cooled water from the bottom of the radiator up through the water jackets. The clutch is of the internal expanding type, which has the following advantages: lack of weight, and a consequent lack of inertia, or flywheel effect, which is apt to prevent the quiet and quick shifting of the gears; ease of gripping; and an even distribution of the wear, which is taken up automatically. There is also no end-thrust with this type of clutch. A novel feature is the possibility of adjusting the distance of the pedal from the front seat to suit the length of the driver's leg. The transmission, which we illustrate, is a typical four-speed sliding gear of the selective type. Ball bearings are used throughout, and provision is made for oiling them from the gear case. As may be seen in the cut, there are two sets of sliding gears operated by two shifting forks. Two of the three bars shown operate these forks. The bars are locked by a transverse rod passing beneath them and through notches on their under surface. This locking rod (which is seen at the right-hand end) has a single notch which, when it is brought under any rod, frees it so that it can be moved back and forth by a vertical lever having a ball tip, which slips into the notch seen on the upper surface of each rod. The main shifting lever works in an H-shaped quadrant.



The side movement of this lever accomplishes the selecting of one of the three rods, while the forward and backward movement shifts one or the other set of gears forward or back, as the case may be. The advantages of this type of transmission are that the operator can always change from one gear to the other without passing through any idle gears. For instance, he can pass immediately from the low speed to the fourth speed without throwing any gears into mesh except those of the latter speed. While this is an advantage for a skilled operator, a straightforward movement is easier for the beginner, and, consequently, gears of the ordinary three-speed type are generally preferable. The Peerless bevel-gear drive is also shown. The differential is open, and two of the spur pinions can be seen through the casing. On each side of the differential are ball bearings and universal joints. The latter allow of a slight movement of the driving shafts, which extend through the tubular rear axle and drive the wheels through jaw clutches on the hubs. The wheels themselves revolve on adjustable ball bearings on the tubular axle. The universal joints mentioned make it possible to dish the wheels slightly, which adds somewhat to their strength. There is also no binding if the axle gets out of line. This rear-axle construction has always been a feature of the Peerless car. The wheel base of the new car is 107 inches, and the wheels are 34 inches in diameter. The two rear springs are connected by a transverse spring that supports the body in

the center, and makes a very easy-riding car. Besides the 30-horse-power car, a 45-horse-power model is also built.

HIGH-POWERED AMERICAN TOURING CARS.

(*Continued from page 32.*)

has a 104-inch wheel base, and weighs complete 2,300 pounds.

THE ROYAL 50-HORSE-POWER TOURING CAR.

The 1906 car put out by the Royal Company has practically the same chassis as the racer which made such a fine performance at the Vanderbilt cup race last October. The motor has a bore and stroke of 5 and 5½ inches, respectively. It is fitted with mechanically-operated valves on opposite sides, the cylinders being cast in pairs, and the valves being interchangeable. The bearings are bronze on the crankshaft and hardened steel at the wrist pins. They are all of sufficient surface not to require replacement more than once a year. The gears which drive the cam shaft are of fiber, uninclosed. The commutator is placed on top of the cylinders and is driven by bevel gears from the cam shaft. The centrifugal pump, which is also bevel-gear-driven and inclosed, can be seen in the view of the motor. The motor is fitted with a positive mechanical oiler which effectually lubricates all its parts. The ignition system consists of quadruple coils and storage batteries. It is of the usual jump-spark type. The radiator, of the cellular type, has a large belt-driven fan behind it. The Royal clutch is of the conical leather-faced type. It is of large diameter and has flat springs beneath the leather for the purpose of making it take hold easily. A universal joint is used between engine and transmission in addition to the usual two joints in the propeller shaft. The transmission, shown herewith, is of the sliding gear type, giving three speeds ahead and reverse with a forward and backward movement of one lever. The shafts are mounted on ball bearings and the gears are bolted to flanges made solid with the shafts, instead of being keyed or pinned. The gear case is suspended from the upper half by means of hangers, which makes it possible of removal without taking out the bolts which fasten it to the car, as by separating the two halves of the gear case, the bottom part carrying the gears can be immediately dropped. The intermediate reverse pinion is carried upon a short shaft in the upper part of the case, and when not in use is thrown out of mesh by a spring. The rear axle is of the live bevel-gear-driven type, the weight of the car being carried on the tubing which surrounds the driving axle. Roller bearings are used in the axle and wheels.

THE 50-HORSE-POWER HAYNES TOURING CAR.

Although one of the oldest automobile firms in America, the Haynes Company, of Kokomo, Ind., nevertheless obtained valuable experience in the past year with a racer built for the Vanderbilt race. This car made one of the steadiest-running performances of any in the race, and won fourth place. The 50-horse-power 1906 touring car is practically a duplicate of the racer, it having all the features which were tried out on the latter. Besides the peculiar roller bevel-gear drive employed on last year's cars, the new Haynes has an ingenious ratchet arrangement in the main driving gear of the transmission for the purpose of making it possible to jump back from high to intermediate or low speed when the car is running rapidly, without the danger of stripping the gears. This danger is a very grave one with all ordinary transmissions of the sliding type. By means of a ratchet in the main driving gear, this gear is allowed to run ahead of the driving shaft when the gears are changed from a higher to a lower speed, which ordinarily results in the car tending to drive the engine and consequently being brought up with a shock. So severe is the strain on the gears under these conditions that a 2,750-pound car carry-

ing a normal load undergoes, when the gears are changed from high-speed (30 miles per hour) to intermediate (15 miles per hour) a shock to its mechanism equivalent to a vertical fall of 7 feet. The new construction does away with this shock completely and the life of the gears is greatly increased by it. Another feature of the new car is a solid inner live rear axle. This is fastened to one side of the differential and to the corresponding rear wheel, while the other side of the differential is attached to a sleeve slipped over the axle and driving the other rear wheel. Both axle and sleeve run in roller bearings of ample size. This type of bearing is also used on the ends of the engine crankshaft, and in the transmission. A new inclosed universal joint which transmits the power through the wide, flat surface of the forks is another feature of the car. The clutch is of the band brake type, having springs in the drum for the purpose of cushioning the latter when the band takes hold. The water pump is a very powerful one, and the motor, which has a 5⅛-inch bore by 6-inch stroke, has liberal water jackets. Special double piston rings are used with this motor. A mechanical oiler has leads to each cylinder and the crankcase.

THE LANE STEAM TOURING CAR.

A firm which has done much to promote the use of the steam vehicle in this country, and which still pins its faith to this type of machine, is the Lane Motor Vehicle Company, of Poughkeepsie, N. Y. The Lane car shown on page 33 embodies all that is best in steam vehicle construction, and is an up-to-date machine in every particular. The boiler, which is a combination flash and water-tube affair, is placed in front under the bonnet. The engine is located in an inclined position under the footboard, and the gasoline tank is under the front seat. A single chain from the engine crankshaft to the differential on the rear axle drives the car. The layout of chassis just described is one which was employed with success last year by two American constructors. It has been adopted by the Serpollet firm of France for this year. Thus, while France is said to lead the world in gasoline car construction, one of her leading steam-car makers has adopted an American design. The arrangement of the boiler in front takes away the heat from beneath the seats, and allows of much more space for carrying purposes. The engine is readily accessible by removing the floor boards, and the boiler by removing the bonnet. The claim is made for the Lane boiler that it has the economy of the regular flash-tube type, the reserve of the water-tube boiler, and a better draft than either. The burner is made entirely of tubing, and is said to be indestructible. The engine is completely incased and protected from dust. It is of the cross-compound type, with 3¼ and 5¼-inch cylinders and a stroke of 3½ inches. The steam chests are placed side by side between the cylinders, and they carry on their back surface the control device for running the engine simple or compound. This is operated by a pedal extending through the floor, and by means of it the engine may be made to exert two and one-half times its normal power. The engine is mounted in a frame of steel rods, suitably braced. The crankshaft, with its eccentrics, flywheels, sprocket disks, cranks, and counter-balances, is a single piece of hardened steel having its bearings ground. The crankshaft and wrist pins have roller bearings, and the eccentrics ball bearings. Both the air and water pumps are inside the oil-tight casing, and are directly actuated by the crosshead. Experience has shown the makers that the piston and valve rods carry sufficient oil into the interior of the engine to lubricate the cylinders properly. An oil cup for this purpose is placed on the dash, but it is only intended to be used occasionally when starting. The automatic by-pass for the water is operated by a thermostat, which depends upon the water level in the boiler. There is also a hand by-pass arranged on the steering post for use, if necessary. The air pressure on the fuel tank is maintained automatically by an air pump driven from the engine. The maximum pressure this pump can produce is determined by an adjustable clearance space, having a considerable range of adjustment from the outside. An independent steam air pump for emergency use and for tire inflation is also provided. The boiler is fitted with a fusible plug in case the water level falls within three inches of the bottom. This plug can be replaced without stopping the machine. The condenser, seen on the front of the car, is constructed of thin, flat, brass tubes, arranged vertically with their edges toward the front and air spaces between them. The steam enters a header at the top, and the water flows out at the bottom, and is returned to the tank by the back pressure. The top carries a coil for heating the feed water on its way to the boiler. The condenser is said to return practically all the water when the engine is running compound under normal conditions. The dash of this touring car is fitted with a considerable number of gages for indicating all that should be known by the operator when driving the car.

THE RAMBLER AUTOMOBILES.

Besides the regular runabout and touring car of the single-cylinder and double-opposed-cylinder type which have been regularly made by the Jeffery Company, this concern has brought out for 1906 a standard four-cylinder touring car with a three-speed sliding gear transmission, shaft drive, and all the usual features of this type. The engine consists of four individual cylinders having a 4-inch bore and 4½-inch stroke and rated at 20 to 25 horse-power. It has mechanically operated valves placed directly in the cylinder heads and opened by rocker arms on top of the cylinders. The rocker arms are made adjustable for the taking up of any wear; and the valves and cages may be removed readily for the purpose of grinding. The cam-shaft gears are inclosed in a dust and oil proof casing. The pistons of the Rambler engine are provided with six rings each, the rings being located in pairs with their joints at opposite points. Great care is taken in fitting the rings and pistons. The motor is fitted with a jump-spark ignition system, the source of energy being a six-volt, 60-ampere-hour storage battery. Individual Splitdorf coils are mounted on the dash. A safety device is fitted to the engine for the purpose of retarding the spark when the crank is released from the holding latch, in order to start the motor. The mechanical force-feed oiler is placed on the dash, with sight feeds in full view of the operator. A float-feed carbureter with an automatic air valve supplies the motor with the proper mixture. The throttle is controlled by a special wheel just under the steering wheel. This control is peculiar to the Rambler cars and is used in combination with an accelerator pedal. The spark advance is inter-connected with the wheel throttle control, so that the spark is advanced ordinarily as the throttle is opened. Under conditions where this is not desirable, however, the spark may be retarded and the accelerator opened to obtain full power. The clutch is interlocking with the gear-shift lever, so that it is impossible to change gears without first disengaging the clutch. The car has two sets of brakes, the regular brake being on the differential drum, and the emergency brake being of the expansive type placed within the rear wheels. This company also makes a larger four-cylinder car having a 5 x 5½-inch motor of 35 to 40 horsepower and fitted with a countershaft and chain drive to the rear wheels instead of the bevel-gear drive used on the lighter model. The larger car is a trifle longer than the others and is provided with 34-inch wheels and 4-inch tires. A Limousine model is also one of the products of the Rambler factory, which is this year

turning out one of the most complete lines of cars of any factory in the country.

THE COLUMBIA 40-45-HORSE-POWER TOURING CAR.

The new Columbia heavy touring car is much the same as the 1905 model, though the new "Mercedes" type bonnet and several changes in the body have changed its general appearance. The motor is made up of two pairs of 5 x 5 cylinders. It develops its rated power at 800 R. P. M., but it has a range of from 150 to 1,500 R. P. M. under throttle control. The mechanically-operated valves are in a chamber on one side of the cylinders. The inlet valves are directly above the exhaust valves, and are opened downward by vertical pull rods having arms on their top extending over the valve stems. A cam-operated lever within the crank-case draws each rod downward and opens the inlet valve. The breech-lock scheme of fastening the spark plugs in place is retained. The ignition is by jump spark with quad coil on the dash and storage batteries as a current source. The crankshaft is made from a solid slab of steel. The car has a 3-speed sliding-gear transmission and chain drive to the rear wheels. Roller bearings are used in the wheels. Both brakes are interconnected with the clutch, which is of the leather-lined cone type in the flywheel.

All the Columbia cars are fitted with a new automatic governor having no needle valve or gasoline-feed adjustment. The auxiliary air is let in by a sliding piston, which uncovers ports in the bottom of the carbureter. The governor operates a by-pass valve and not the throttle. The latter is connected to a pedal. The new 24-28 horse-power four-cylinder light car has low-tension magneto ignition besides several other improvements. The E. V. Company also manufactures the same 18 horse-power double-opposed-cylinder car that it marketed last year. In electric vehicles, a brougham with cross seat in front for driver is one of the new models.

THE GROUT GASOLINE TOURING CAR.

The Grout Brothers Automobile Company, Orange, Mass., has once more turned its attention from the steam to the gasoline car, and a new, large touring car (shown on page 33) of 30 to 35 horse-power is the result. This machine is of the standard four-cylinder type, having individual, integrally-cast cylinders, with mechanically-operated valves placed on one side and driven from a single camshaft. The valves, as is usual with most modern cars, are all interchangeable. The ignition system, of the jump-spark type, is carried out with the use of a single coil and a new pattern of high-tension distributor which allows of the use of rigid wires. An improvement is also to be noted in the spark advance mechanism. Instead of moving the box itself, the revolving wiper is made to advance on its shaft. The motor and transmission are oiled by a novel force-feed lubricator, having a single pump and a distributing valve, which sends the oil through the various pipes. The transmission is of the usual three-speed type with direct drive on the high speed. The countershaft at the rear of the gear box runs on roller bearings, and has a band brake operated by a pedal. A double chain drive to the wheels is employed. The main frame of the Grout car is of armored wood, strengthened at the corners by steel braces. The power plant is mounted on a sub-frame of channel steel. Ball bearings are used in the wheels, which are shod with 32 x 4-inch tires having non-skid treads. The car is controlled from the steering wheel, the ignition and throttle levers being mounted on segments, which remain stationary when the wheel is turned.

THE AMERICAN MERCEDES AUTOMOBILE.

The product of the Daimler Manufacturing Company, illustrated on page 33, is said to be an exact duplicate of the world-famed machine made by the Daimler Motoren-Gesellschaft. The American

company has acquired the complete specifications of the German machine, and in some instances has imported parts from Germany. The materials used in the construction of the American Mercedes are required to pass the same rigid tests used abroad. The steels used in the axles, crankshafts, gears, and gearshafts are made from a special alloy said to have a tensile strength nearly double that of the best axle and shaft steels obtainable here. Thus, it will be seen that as far as material is concerned, the American car should be equal to its more celebrated brother. The motor is a four-cylinder engine having its cylinders in pairs and the valves placed symmetrically. All the valves are operated mechanically, and mechanical make-and-break igniters are also employed in connection with a Simms-Bosch magneto. Sight-feed oilers located on the dash and fed by pressure are used for lubricating. There is also an auxiliary hand oil pump. The transmission is of the latest Mercedes type, in which there are two bevel gears on the differential. One of these is driven from the secondary shaft of the transmission, while the other is used only on the high speed when a direct through drive is maintained. Chain drive to the rear wheels is employed, and Brampton self-hardening steel chains are used. The car has two separate pedal brakes working on the transmission, as well as expanding brakes in the hubs of the rear wheels. The engine develops 45 horse-power at 1,000 R. P. M. The cylinders are 120 by 150 millimeters. The valves are twice as large as those used last year, and the metal expanding clutch is inclosed and runs in oil. The engine crankshaft is mounted in non-adjustable ball bearings of the type shown on page 34.

THE RAPID MOTOR VEHICLE COMPANY'S TRUCK.

The truck shown on page 33 is fitted with a double-opposed-cylinder motor placed fore and aft of the vehicle beneath the driver's seat. This engine has a 5-inch bore and stroke, and is rated at from 16 to 18 horse-power. It is connected direct to a planetary gear transmission, giving two speeds forward and reverse, and which is mounted at its outer end in a special form of bearing, which can adjust itself to any mis-alinement caused by strains upon the frame. A chain from the engine crankshaft runs back to a countershaft just forward of the rear springs, and the wheels are driven by individual chains from this countershaft. Roller bearings are used throughout, and the car is mounted on exceedingly heavy springs, of which there are a considerable number. Transverse springs are used at front and rear, besides a supplementary transverse spring over the rear axle. This latter spring only comes into play when the car is heavily loaded. The body of the truck is very strongly constructed, and is heavily ironed throughout. The motor is lubricated by a mechanical oiler of novel design, which has but one plunger that forces the oil through a series of holes at every stroke. The commutator is placed in a very accessible position at the side of the car. The construction throughout is of the simplest and most substantial sort. A multiple-disk clutch is used for the high speed, and it is claimed that the car can be started on an incline when fully loaded by simply throwing in this clutch. The machine shown is intended for a load of a ton and a half, but it will carry heavier loads if necessary.

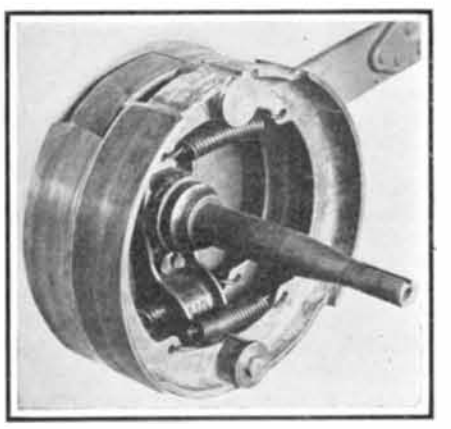
OLDSMOBILE BUS.

The bus shown on page 33 is a 20-passenger rig, mounted on the largest commercial vehicle chassis that the Olds Motor Works produce. This chassis is fitted with a vertical 2-cylinder engine located under the driver's seat, and having a planetary gear arranged on its crankshaft. A Morse silent chain runs back from this shaft to a countershaft in front of the rear springs, and an individual chain from this countershaft drives each rear wheel. The machine is fitted with

roller bearings throughout. The wheels are large, and are shod with solid rubber tires. A speed of 15 to 18 miles an hour is obtainable on the high gear, and this machine will be found very serviceable for carrying on a bus business where the roads are fairly good.

THE NATIONAL SIX-CYLINDER TOURING CAR.

Without a doubt one of the largest and finest American machines is the new six-cylinder National. This car has a 4½ x 5-inch engine, having individual cylinders and mechanically-operated valves in a single valve chamber on each cylinder. These valves are worked by a single camshaft. The crankshaft of the engine is supported in five large bearings, and the crankcase is divided into four compartments. It is also provided with handholes of large size, so that the crankshaft bearings can be readily inspected. Jump-spark ignition with individual vibrating coils and a dynamo, storage and dry batteries as sources of current supply are used. The dynamo is placed on end just back of the dash, so that its bevel friction pulley runs against the side of the motor flywheel. The commutator can be readily reached by removing a cap. A positive mechanical oiler is used for lubricating the engine. The water-circulating pump is driven from the camshaft, and is readily removable without disturbing any parts of the engine. The same type of clutch having flat springs beneath the leather is used. The clutch is interlocked with the brake and gear levers. The propeller shaft and the transmission shafts are mounted on non-adjustable ball bearings. A feature of the National car that is noteworthy is the employment of two tie-rods between the steering knuckles of the front wheels. The hub of each rear wheel is fitted with two internal expanding brakes, as shown in the accompanying cut. This is a new feature found on but few of the 1906 cars. One of these brakes is operated by a pedal, and the other by the emergency lever. The steering gear is of the worm type, and is non-reversible. The body used on the car is of cast aluminium. It is very commodious, and has a capacity of seven passengers, all facing forward. The control of this car when running on the high speed is so complete that it can be speeded from 3 to 60 miles an hour simply by opening the throttle. A four-cylinder National car holds the record of 1,094 3-16 miles in twenty-four hours. This means an average speed, while the car was running, of 51.9 miles per hour. The record was made upon the track at Indianapolis on November 4 last, and it was an excellent demonstration of smoothness and steadiness of running. Two cars made the attempt on the previous record, but one was driven through the fence by accident at night. The other car continued in its race against time, and succeeded in beating the previous record by 78 9-16 miles. It also broke the 150-mile record, and all the other world's records from 650 to 1,050 miles. A test of this kind is one of the most severe that can be given a car, and one which approximates rather closely to what it will have to do when driven at high speeds over good roads.



TWIN EXPANDING HUB BRAKES.

THE STODDARD-DAYTON TOURING CAR.

An excellent example of a modern 4-cylinder touring car is that made by the

The Morgan & Wright Automobile Tires.

A firm that has done much toward bringing the automobile tire to its present improved state is the Morgan & Wright Company, of Chicago. This company was well known for its bicycle tires some years ago, and it has consistently maintained its reputation by the manufacture of first-class tires. The 1906 line manufactured by this firm is said to have several distinct improvements as follows: In the first place, an increase in fabric strength of something like 40 per cent over the fabric ordinarily used has been obtained by a special method of manufacture. Furthermore, the fabric is so laid down in constructing the tire that the latter, when finished, has the precise shape that it would naturally have when inflated, and consequently there is no undue strain of the fabric set up when inflation takes place. Another advantage found in the Morgan & Wright tires is that not only the tread but the whole tire is wrapped throughout in its construction. The "wrapping" process, which is rather of a mystery to the layman, is the process of laying in place by hand several layers of fabric, in order to insure a correct placing of said layers. In this way they obtain the position which they were to assume naturally, and they are not subjected to undue strains of stretching. This process is generally used on the tread only, but with the Morgan & Wright tire it is used throughout. The fourth improvement is the employing of a very tough grade of specially compounded stock for the tread of the tire. The balance of the tire is made of the highest grade Para rubber, which gives the tire great resiliency. These tires are made in several styles, including the Clincher rim, the Dunlop rim, and with the Baily "Won't Slip" tread. This tread consists of a series of disk-like raised places on the tread of the tire, which keep it from slipping under the most adverse conditions, and also aid in preventing punctures. The Dunlop tires are made of the very best materials. The rings which secure the tire to the rim are of imported piano wire. The great care which is used in the construction of the tires will be apparent when it is stated that the makers keep an expert constantly on duty at the mill which supplies them with the fabric, for the sole purpose of inspecting the raw material and rejecting any which shows the slightest impurity. The record of these tires for resiliency and durability is of the highest, and the reason for this is readily seen in the care which is taken in their construction.

HIGH-POWERED AMERICAN TOURING CARS.

(*Continued from page 54.*)

Dayton Motor Car Company, and known as the Stoddard-Dayton. This machine is a high-class car in every respect. It is fitted with a 4½ x 5 Rutenber motor having interchangeable, mechanically-operated valves, all on one side. The inlet and exhaust pipes may be detached readily by removing four nuts. The connecting rods are adjustable at both ends. A mechanical pressure-feed oiler operated by an eccentric lubricates the engine. This is controlled by spark and throttle levers on the steering column. The brake pedal, when pushed, also throws out the clutch, and both pedals are connected so as to close the throttle and prevent the engine from racing. The transmission gives three speeds and a reverse. It is of the selective type and is controlled by a single lever working in an H-shaped quadrant. A double universal joint is fitted between its forward end and the clutch, which is of the standard cone type with ball thrust bearing. The rear axle is of the usual live floating type employed almost universally nowadays with a bevel-gear drive, the wheels turning on roller bearings on the ends of the incasing tube and being driven by the inner live axle through jaw clutches in the hubs. Expanding-ring brakes lined with camel's hair are fitted in the wheels, and a transmission brake operated by a pedal is also provided. The car has a 103-inch wheelbase, and 32 x 4-inch tires.

AUTO-CAR EQUIPMENT COMPANY'S COMMERCIAL VEHICLES.

This concern makes a specialty of vehicles for commercial purposes, such as passenger omnibuses, delivery wagons, trucks, and sight-seeing automobiles. One of the new models on exhibition at the Armory Show is a 12-passenger wagonette, fitted with a double-opposed motor of 18 horse-power, mounted crosswise beneath the body. This motor is in an accessible position and is fitted with a planetary transmission, giving two speeds ahead and a reverse. It drives, through an inclosed bevel gear running in oil, the countershaft from the ends of which chains extend to the rear wheels. The machine is very compact and neat in appearance. Its length over all is 9½ feet. It is fitted with movable sashes, which can be taken out in the summer, and which thus make it a practically open vehicle.

Another machine turned out by this firm has a handsome closed body designed to carry fourteen people, while two more may be carried on the driver's seat. The body is mounted on the running gear by a three-point suspension. The car is fitted with large 36-inch wheels having 3½ and 4-inch endless solid rubber tires in front and rear. Roller bearings are used in the wheels, which also have integral brake drum and sprockets attached. The car is driven by a four-cylinder vertical motor placed in front. This engine is said to develop 34 B.H.P. at 1,000 R. P. M. Its valves are all mechanically-operated and located in the cylinder heads. The motor is connected to a two-speed transmission, the gears of which are of wide face and heavy pitch. The machine has a wheel base of 120 inches, and its length over all is 13½ feet. It is proposed to have one of these cars running between the Garden and the Sixty-ninth Regiment Armory during the show week. An electric hotel bus somewhat similar in design is another of the models manufactured by this concern. The company also makes a 3-ton gasoline truck, having the same power plant as the 16-passenger wagonette. This truck will travel 10 miles an hour at high speed. It is fitted with a stationary or removable top, as the purchaser may desire. A novel feature of this truck is sand boxes and valves for sanding the road in front of the rear wheels, should this be found necessary.

THE 1906 WHITE STEAM MACHINES.

The new White steam car has a very much lengthened wheel base and a roomy side-entrance tonneau body. The power plant is practically identical with that used last year, the compound two-cylinder vertical engine being placed in front under the bonnet, and the flash generator being situated under the forward seat. The car is fitted with bevel-gear drive and disconnecting clutch, for the purpose of allowing the engine to run idle for a few moments at the start. In connection with this clutch a secondary gear is provided, by which the car can be run at half speed when the engine is making its full number of revolutions. This lower gear can be used whenever the road conditions necessitate slow traveling and increased power. Ball bearings are used in the engine, transmission, rear axle, and wheels. The engine is lubricated by a belt-driven oiler located on the dash. The crankcase is filled with oil, and the splash from the cranks is relied on for oiling crankshaft bearings. The low speed, bevel, and differential gears all run in oil. This thorough lubrication of all wearing parts is a point which has received special attention with the new models. The engine of the 1906 car is rated at 18 horse-power. There are several forms of closed bodies constructed by this company, any one of which can be used upon the standard chassis. This chassis consists of an armored wood

frame 13 feet 5 inches in length, and carrying at its front end the motor, which is directly connected to the rear axle by a universally-jointed propeller shaft. Two powerful brakes are provided; one, a foot-brake, acts upon the flywheel by means of expanding shoes, while the other, the hand brake, is connected with expanding shoes within the hub drums of the rear wheels. The wheel base of this chassis is 9½ feet. It is fitted with 34-inch wheels having 4-inch tires, and the weight of the complete touring car is 2,275 pounds.

THE DECAUVILLE MODELS FOR 1906.

In the Decauville exhibit at the Madison Square Garden Show will be found representatives of the five models constructed for 1906. All are built upon the patented frame, in which a steel pan stamped integrally with the side bars of the frame supports the engine and gear case. The engine has four vertical cylinders cast integrally in pairs, with valve chambers on opposite sides. It is automatically oiled through a sight-feed lubricator, and is fitted with high-tension ignition by means of a magneto or batteries. The carbureter is of the automatic type controlled by the speed of the engine. Gasoline is supplied by pressure from the gasoline tank. A honeycomb radiator fitted with a fan, and having its water circulated by means of a positively-driven gear pump, is used on all the cars. All of the driving gears are inclosed and run in oil. The five different sizes of cars are fitted with 12-16, 16-20, 26-28, 30-35, 45-60 horse-power engines. The two larger cars are fitted with side-chain drive, while the three smaller ones have shaft drive. The lowest-powered car is capable of a speed of from 30 to 35 miles an hour, while the 60-horse-power machine will travel from 50 to 60 miles an hour. The Decauville Company's exhibit of foreign cars is one of the most complete at either show.

THE NEW DARRACQ LIGHT TOURING CAR.

In view of the fact that the Darracq machine won the Vanderbilt cup, and that an extremely high-powered racer has been built recently with a view to capturing the two-mile-a-minute trophy at Ormond, a brief description of the light Darracq touring car, marketed in this country by the American Darracq Co., will no doubt be of interest. A 20-32 horse-power model has a four-cylinder vertical engine of 112 millimeters bore by 120 millimeters stroke, the cylinders being cast in pairs. The engine drives a three-speed sliding gear transmission, which is in turn connected through the usual universally-jointed propeller shaft and bevel-gear drive to the live rear axle. The three forward speeds and one reverse are obtained with a single lever. The clutch used in the engine flywheel is a leather-faced cone, having four springs beneath the face to allow of easy engagement. The clutch pedal is connected with the throttle in such a way as to close this when the clutch is disengaged. The throttle lever is located on a stationary sector in the steering wheel. The car is fitted with internal expanding brakes on the propeller shaft and rear wheels. The engine is lubricated by splash, the level in the crankcase being maintained by a small paddle pump, driven off the camshaft, and which sends oil through sight feeds on the dash to the crankcase. Either high-tension ignition by coils and accumulators, or low-tension magneto ignition is used. The wheel base of the machine is 120 inches. It is fitted with 880 x 120-millimeter tires in the front and rear; and the speed it is capable of making is in the neighborhood of 50 miles an hour.

THE FOUR-WHEEL DRIVE TRUCKS.

In our Automobile Number last year we illustrated a new form of gasoline truck, in which all four wheels were driven from suitable countershafts connected with a three-speed transmission. The Four-Wheel Drive Company, of Milwaukee, Wis., have improved this truck, and have now brought out a model in

which all four wheels are shaft-driven through bevel gears. The dispensing with chains on a vehicle of this size and construction should be a valuable feature, as such a machine has to go through all kinds of weather and traverse bad road surfaces, and the four long chains heretofore employed were apt to stretch and become clogged with mud. The new trucks are made in several sizes. The drive by all four wheels gives them great tractive power, and makes them able to extricate themselves from almost any position without difficulty.

The Swinehart Solid Cushion Tire.

The Swinehart tire, which was illustrated in our last automobile number, has been used with success by an increasing number of automobilists during the past year, and almost all of these testify to its good qualities as regards resiliency and speed. While it is generally conceded that with an ordinary solid tire a speed of 15 miles an hour is about the limit, several users of the Swinehart tire have traveled in the neighborhood of 40 miles an hour without serious results or great discomfort, and have proved that this tire is applicable to the heaviest and fastest vehicles, as well as to the runabout and light touring car. The large number of testimonials from users of the tire apparently show that the great troubles of shaking to pieces of the car and crystallization of the parts from excessive vibration are not what they were thought to be. The tire is constructed on very different lines from the ordinary solid tire, it having concaved sides, a rigid tread, and a clincher flange on the bottom. The latter makes it possible to use the tire with the ordinary clincher rim employed with pneumatics. The tires are constructed with rather soft rubber, which has great resiliency; and it is due to this fact and to their peculiar shape that they ride much more easily than the ordinary solid or cushion tire. For the automobilist who wishes to be free from the thought of puncture, there is no better substitute for a pneumatic tire than that made by the Swinehart Company.

A Useful Ignition Battery.

An improved form of storage battery for ignition purposes is made by the Witherbee Igniter Company, of this city. The plates are assembled in separate compartments formed by division walls in the containing hard-rubber case, and the lugs are connected to suitable binding posts in the cover. The latter is sealed in the case by a soft rubber edge, and its overlapping top is bolted to flanges on the latter. The new battery has a new form of plate connection inside, and all metal parts that might cause a short-circuit should water accumulate on the top, have been dispensed with. A new form of vent having a large chamber for the separation of the gas from the acid is fitted. The battery is one of the neatest at present upon the market.

A CLEVER MECHANICAL AND ELECTRICAL AUTOMATON.

(*Continued from page 46.*)

scending and terminating on the right side at a level with the terminal on the left. Upon this track travel fourteen ball-bearing swinging carriages, their movements being controlled by an electric motor. The carriages are filled with dry storage batteries, the combined weight of which is sixty pounds. These batteries are shifted from one side to the other of the body by means of an electric motor controlled by a mercury governor.

At the back of the figure is the switchboard containing the rheostat, fifteen switches, three single levers, and three automatic brakes, besides several other ingenious devices for directing the movements.

The connections are made, the current switched on, and at a given number of degrees or steps regulated by the centered gear-wheel, working on the cam of the motors, the weights are released from

their normal center and rapidly descend into the abdominal cavity on the right, causing the figure to lean forward at an angle of 20 degrees. The motor controlling the left limb being in full operation throws its member forward, the figure being in such a position that this free and rapid movement swings it round to the right; at the same instant the mercury governor, finding its level, forms an electric contact, setting in motion the motor, which rapidly draws the weights back to the line of gravity and causes the figure to regain its equilibrium. By changing the gear wheel, which controls the number of steps, the distance traversed is increased or decreased.

The figure also writes its name, "Enigmarelle," upon a blackboard. The arrangement by which this is done is said to be a series of electro-magnets in the shoulder. These attract an armature in the upper arm and cause the latter to make certain strokes.

The method by which the crowning feat, that of riding a cycle, is accomplished is similar to the walk. At a given number of revolutions the weights again descend into the abdominal cavity, but in this instance on the left, causing the cycle and figure, which are attached, to lean toward the center, at an angle of about 40 deg. with the perpendicular, so that the figure, like a coin or wheel, starts round a circle. The arm locks the handlebar at an angle such that the bicycle will turn the circle desired and the feet revolve the pedals and drive the machine in the regulation manner.

[The photographs of this automaton were submitted to the managers of a well-known New York theatrical enterprise and they at once stated that they had seen the automaton in London and that there was really a man concealed in the midst of this aggregation of machinery.—Ed.]

A 4,000-mile road test of pneumatic and solid tires will be started by the Automobile Club of Great Britain February 1. A complete set (four tires) of each make represented will be placed on an automobile of the weight which such tires are intended to carry. The four main classes are cars weighing, with occupants, 1,500, 2,400, 3,000, and 4,500 pounds respectively. There will be a special class for armored, or otherwise protected, tires. Such tires are to be used on cars of 3,000 pounds weight. In awarding the prizes the size, weight, and price of the tires in relation to the weight carried will be considered. The rules are very strict, and an accurate account will be taken of any extra tires, tubes, or protective devices supplied to the competitors during the course of the test. Any parts replaced are considered as worn out, and charged against the competitor. In the event of a set of tires lasting out the test, the competitor has the privilege of continuing this test at an expense of $10 a day for the use of the car. The test will be continued under the auspices of the club.

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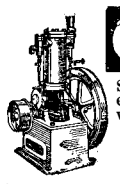

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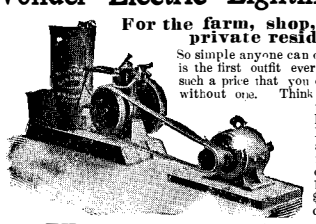

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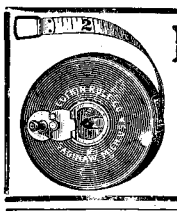

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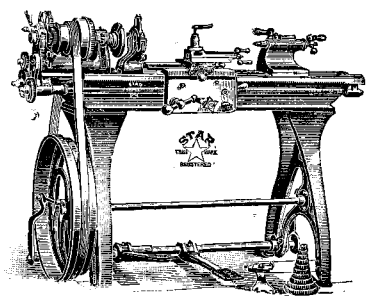

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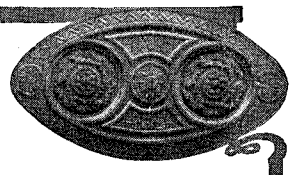

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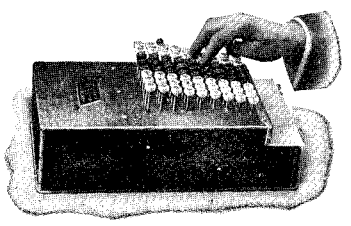

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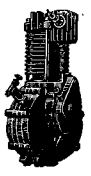

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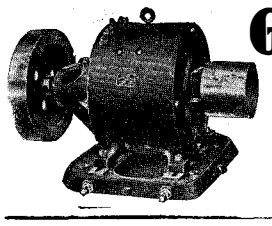

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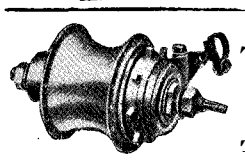

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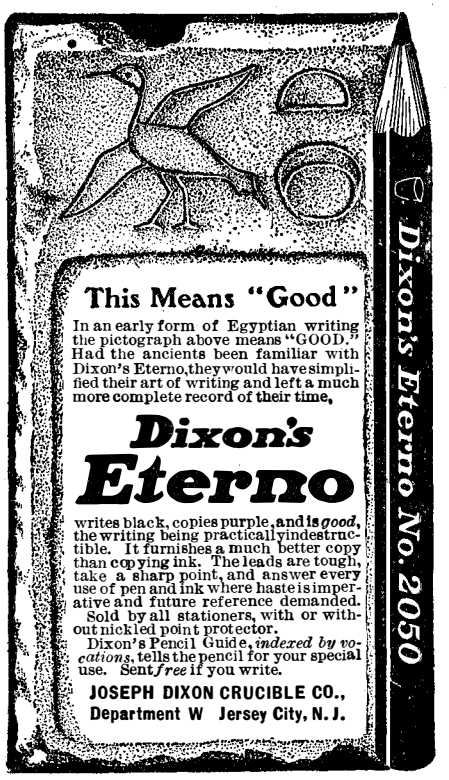

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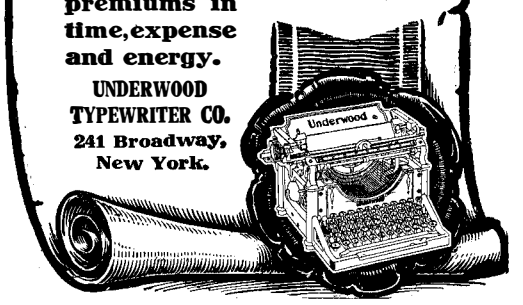

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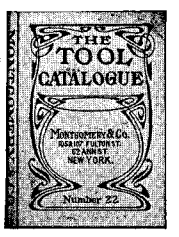

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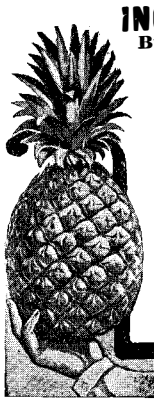

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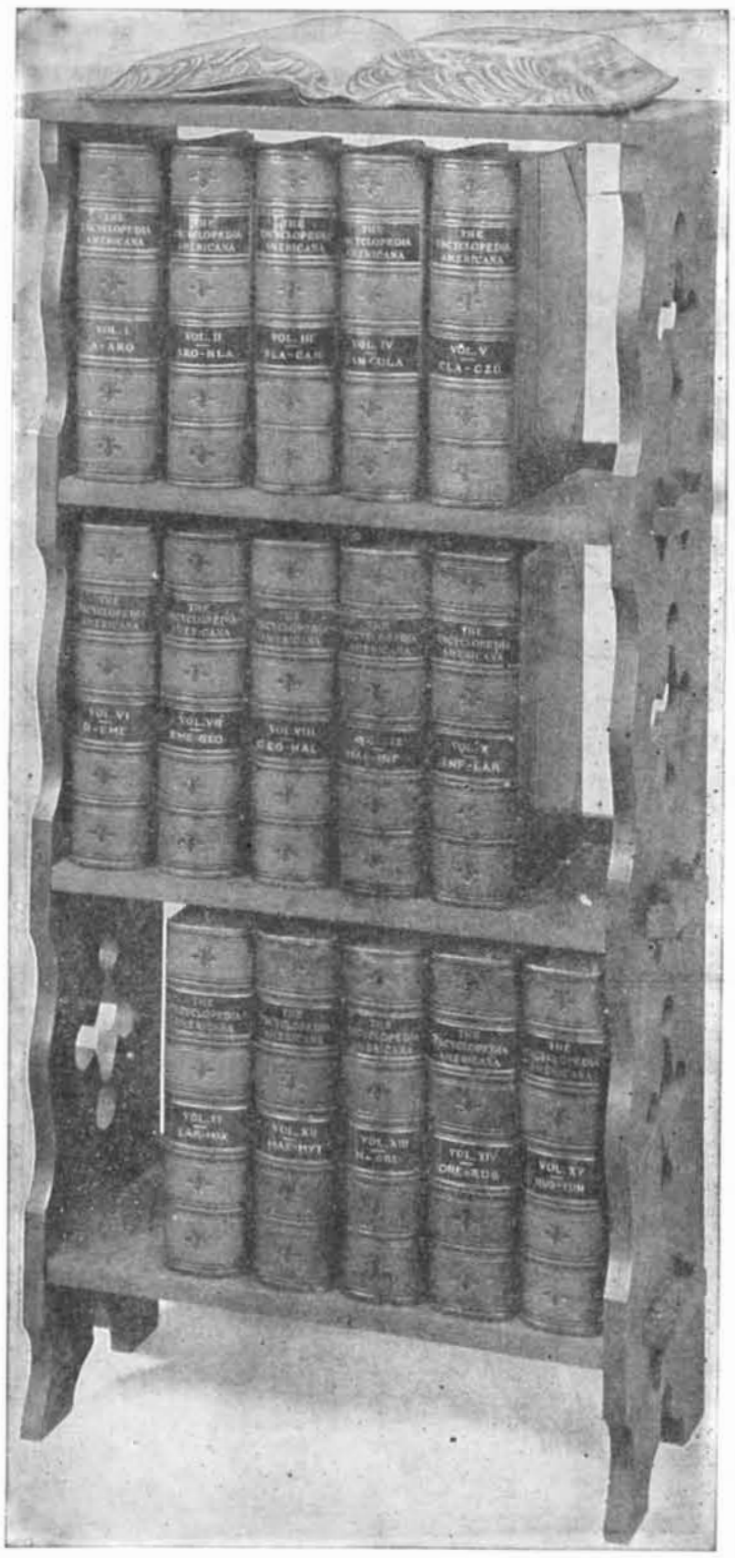

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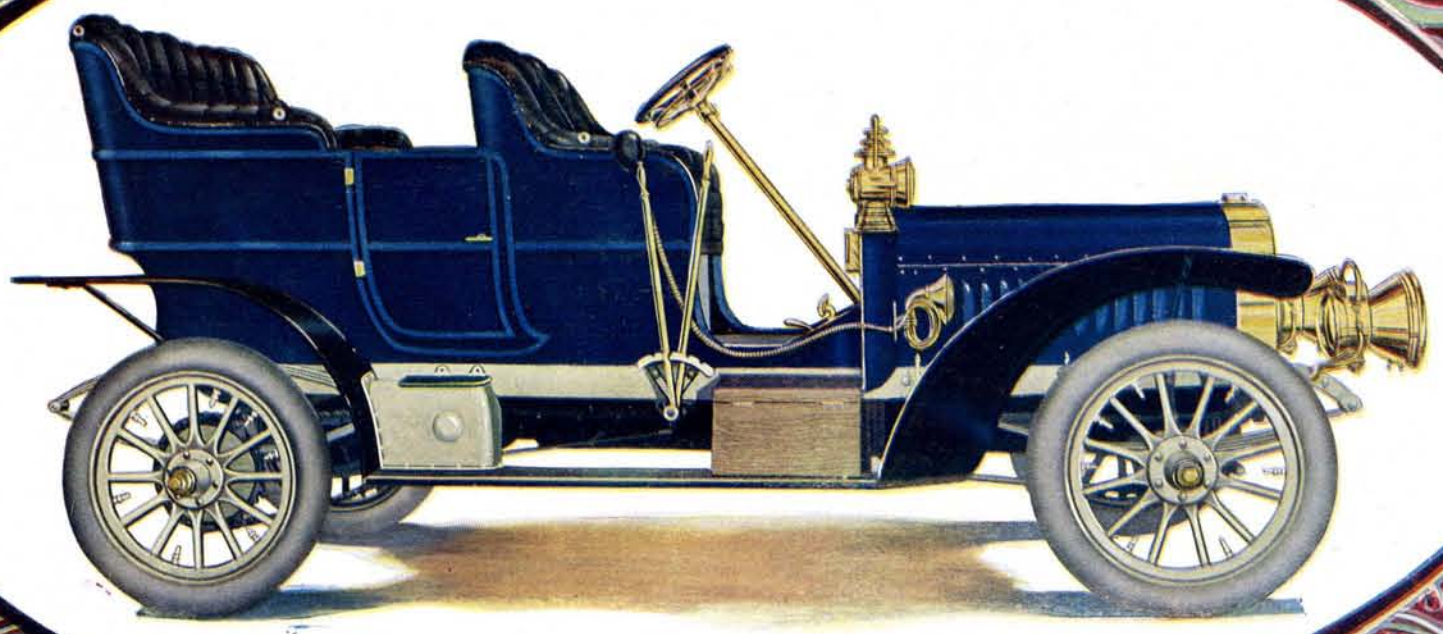

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